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On the Editor's Bench

Sit Write Down

In this issue you'll see that Scribe a Line has grown to three pages. The forums at www.model-engineer.co.uk always contain lively debate on the contents of *MEW*, but I have much thoughtful correspondence in response to recent articles and letters. A straw poll of readers on the forum received the unanimous response that they would like to see as many of these letters as possible. If your note to me hasn't appeared, please be assured there's no conspiracy, despite reader enthusiasm, I need to keep back a few pages for articles!

Bob Symes (6 May 1924 – 19 January 2015)

Many readers will no doubt be saddened to hear of the passing of Bob Symes, the broadcaster and notable modeller. With his enthusiastic, informed and wonderfully paced delivery he inspired a generation with his 'Model World' series in the 1970s, not to mention being a regular on *Tomorrow's World*. He was from Austrian aristocratic stock – his magnificent full name was Robert Alexander Baron Schutzmann von Schutzmandorff. His garden railway was well known – he held regular open days to raise money for good causes. Bob Symes always took a great interest in the world of model engineering and railways



Bob Symes enjoys a drive at the Grand Opening of the brand new Woking Miniature Railway track on 25th May 2002. (M.E. 26 July 2002.)

and always enjoyed his visits to club tracks around the UK.

Bob started out with the BBC as a production assistant, and claims to have established his bona-fides with a short test film of his railway layout that became an official BBC 2 'filler'. If you want to remember him at his best, you can view some wonderful short films of his reminiscences, and some of his TV programmes at wn.com/bobsymes



Lara's Vice

Murray Eddington, who wrote the interesting 'Mind to Metal' article last year caught my attention with a picture he posted on the forum. It shows a rather neat machine vice made by his daughter, Lara, who is studying mechanical engineering at Sheffield University. Murray says 'When I was at university in the 80s (Cambridge and Newcastle), we weren't allowed near the workshops, much to my frustration. It's great to see students are required to do this kind of work as part of the course these days'. All I can do is second that sentiment and congratulate Lara on a very nicely made piece of kit.

Matters Arising

Harold Hall has been in touch to let me know the company who used to supply the Hobbymat MD65 lathe profiled in the last issue are in fact Essel Engineering. Nowadays they specialise in 16mm narrow gauge railway locomotives, although they still carry a range of Hobbymat spares. Their web page www.esselengineering.co.uk has details.

GOOD NEWS FOR ALL READERS

I'm sure that all readers of *Model Engineers' Workshop* will be delighted to hear that it's been agreed that the magazine will be increased in size. From Issue 227 you will be getting an extra eight pages! These extra pages will be feature content, so you will be getting lots more to read in each issue.

This extra space will mean even more variety in each issue, without having to lose any existing favourites. My aim is to strike a balance between traditional content and more innovative aspects of workshop activity like CNC, 3-D printing and other new technology. We will also have a bit more room for more in-depth articles or completing series in fewer parts.

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Inchanga experienced more ups than downs with his Rong Fu mill.

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See page 45 for details.

Coming up...

in the April issue

A SHOP BUILT LATHE

One Man and His Lathe is a bit different from past instalments as Clive Barker describes a home-made machine put together in provincial Pakistan. The machine was used to make a solar tracker for this impressive PV array.



PLUS Mike Cox describes modifications to his bandsaw that improved its usability, Duncan and Sue Louttit describe some of the trials and tribulations – and the satisfaction – of tackling a project for REMAP, the engineering charity supported by MyTimeMedia and Glenn Bunt introduces his clock gear depthing tool, and essential tool for amateur horologists.

Regulars

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Good news from the Editor!

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News from the world of Model Engineering.

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Another great collection of readers' items for sale.

ON THE COVER



R2D2 has created a 3D model of Brian Moseley's mini vice! This full-size model of R2D2 was one of the highlights of the maker area at the Model Engineer exhibition (see page 25). There's a whole online community of enthusiasts building similar models and developing workshop skills in everything from wood and metal to modern composites.



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Screwcutting Clutch by Martin Cleeve

Visit www.model-engineer.co.uk to read a fascinating article by Martin Cleeve on a screwcutting dog-clutch for his Myford lathe, based on the older Exe and Hardinge HLV designs. More details in this month's Scribe A Line.

FREE PLAN:

A Four Jaw Chuck for Small Lathes

This is a really nice plan from Bob Loader, a contributor who has written many excellent articles on accessories for small Unimat lathes over the years.

Don't Do This At Home – A T-slotted Slide for a Mini Lathe

Back when the editor was still a novice, he decided to make a new slide for his mini-lathe, blithely unaware that it was far too big a job for the machine. Unencumbered by experience, he managed the job using some decidedly questionable set-ups. Find out more in this article, but don't try this at home!

Some of the other live topics on the forum include:

- Parting Off MEW225 – lively discussion of theory and practice sparked off by last month's article.
- Clarkson Autolock SType Collet Chuck
- When the right way of tightening up a chuck might not be!
- Flywheel Keyways
- Simple enough to make? Not when the flywheel is fitted to a taper!

Customising a South Bend Lathe



Michael Slatter describes some modifications he has made to his lathe, including plans for his heavy duty tailstock turret.

I purchased this lathe some 20 years ago and have been making changes to it bit by bit over the years. **Photograph 1** shows how it is today.

The author's South Bend lathe.

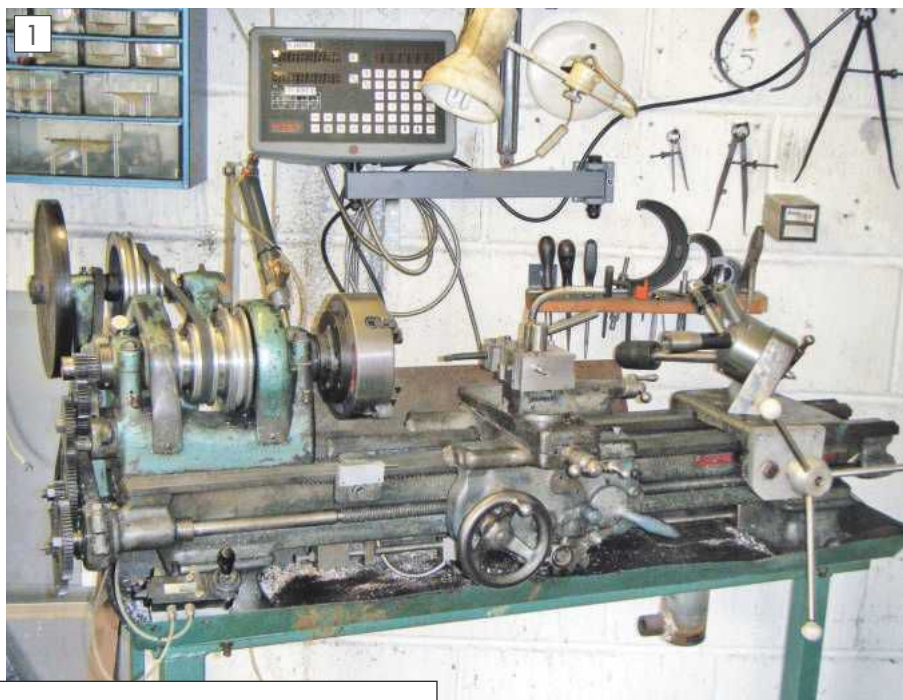
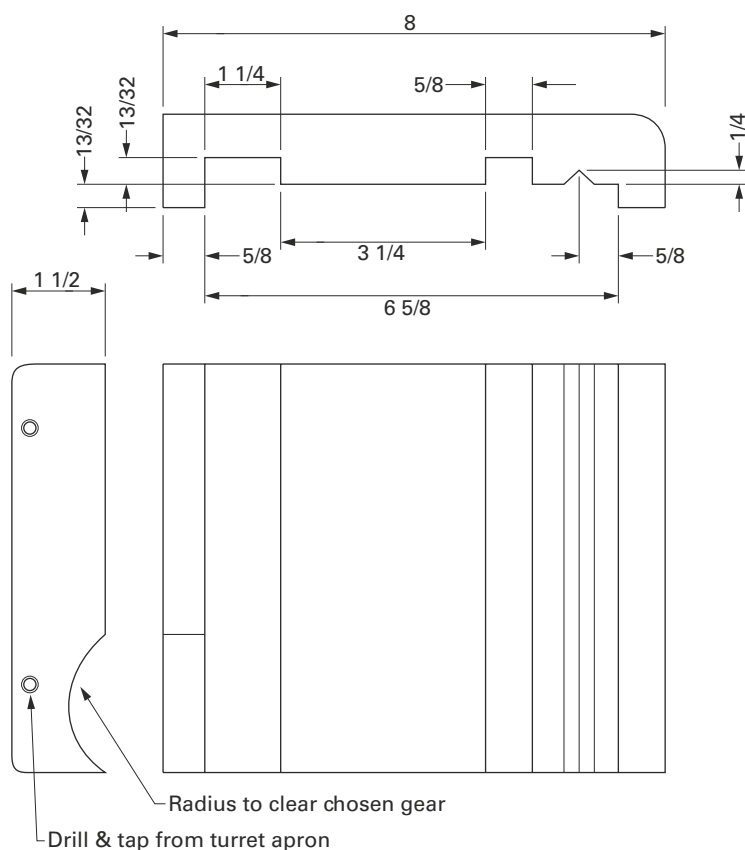


Fig. 1



My first change was a quick change tool post, then I replaced the three speed flat drive with four-speed vee pulleys and used a pneumatic cylinder to provide the belt tension.

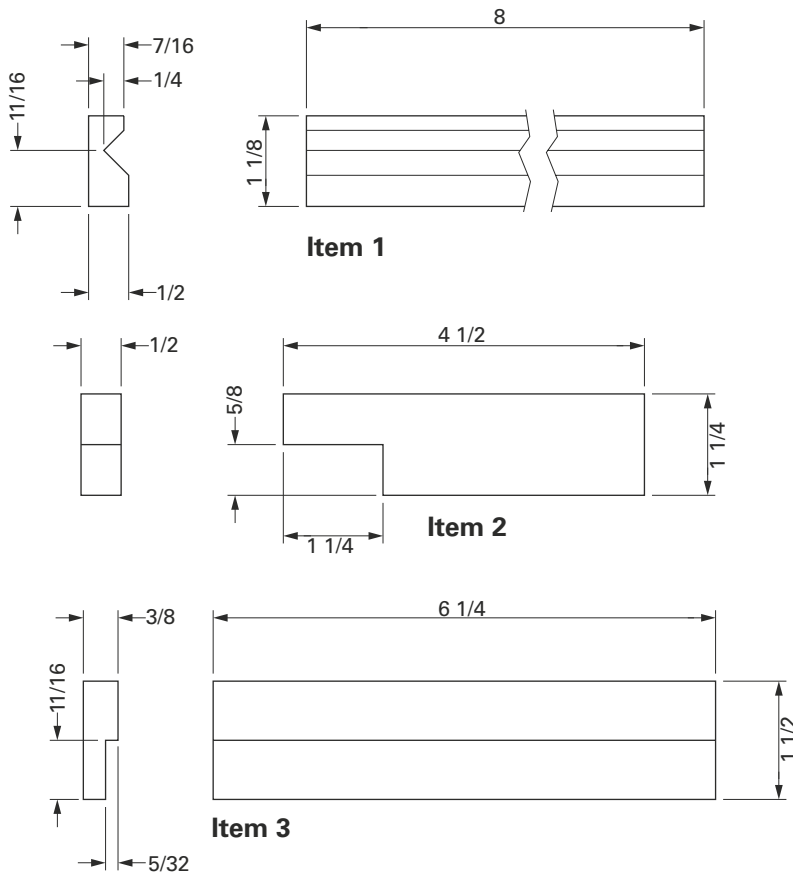
A normal tailstock makes life a bit tedious when changing from centre drill to tapping drill to tap, repeated umpteen times when making several identical parts. I remembered how simple life was when I was using a turret or capstan lathe for production work. The operation is more like a lever feed which gives some degree of feel, unlike a tailstock screw, especially with small drills. This led to me making a turret for the South Bend.

I have not specified thread sizes since it depends on whatever you have in your workshop. In projects like this it is the idea rather than exact dimensions that is important, for instance the reduction gears were left over from some job in the dim and distant past. I made patterns for the two main pieces and had them cast at a foundry, which was more expensive than I had expected, perhaps I should have spent more time with my friendly scrap merchant.

The base was set up in the mill in its horizontal mode and machined as shown in **figure 1**, I had to borrow a 45° cutter from a friend to cut the vee. Alternatively, if you have a friend with a shaper you could ask them to do it for you!

A loose vee, **figure 2** item 1, is made to bear on the other vee of the bed then fixed to the cast base with screws. This is easier than trying to machine them to fit the slideways accurately.

Fig. 2



With the base on the lathe bed item 1 was secured in position with cap head screws. At this point blue the lathe vees and mark the base by sliding it back and forth to ensure that it is bedding properly. The understrips which prevent the base lifting can be made next to the dimensions in figure 2 items 2 & 3, the corresponding holes can then be tapped in the base. The final adjustment to these parts can be made by milling off one face or the other until the base fits the vee and will not lift but slides smoothly. Feeler gauges and shims are useful here.

The backplate, **figure 3**, was milled next on front and back faces then set at 10° to face the base. The 1/2 inch hole was reamed for the turret axle, but this could be any size that suits.

The turret itself, **figure 4**, was machined from a piece of 3.5 inch diameter steel with a 1/2 inch diameter length of ground rod pressed in.

The back end of the axle was tapped for a piece of screwed rod and a large washer located with a pin fitted and 2 nuts used to hold it without any free play but able to turn.

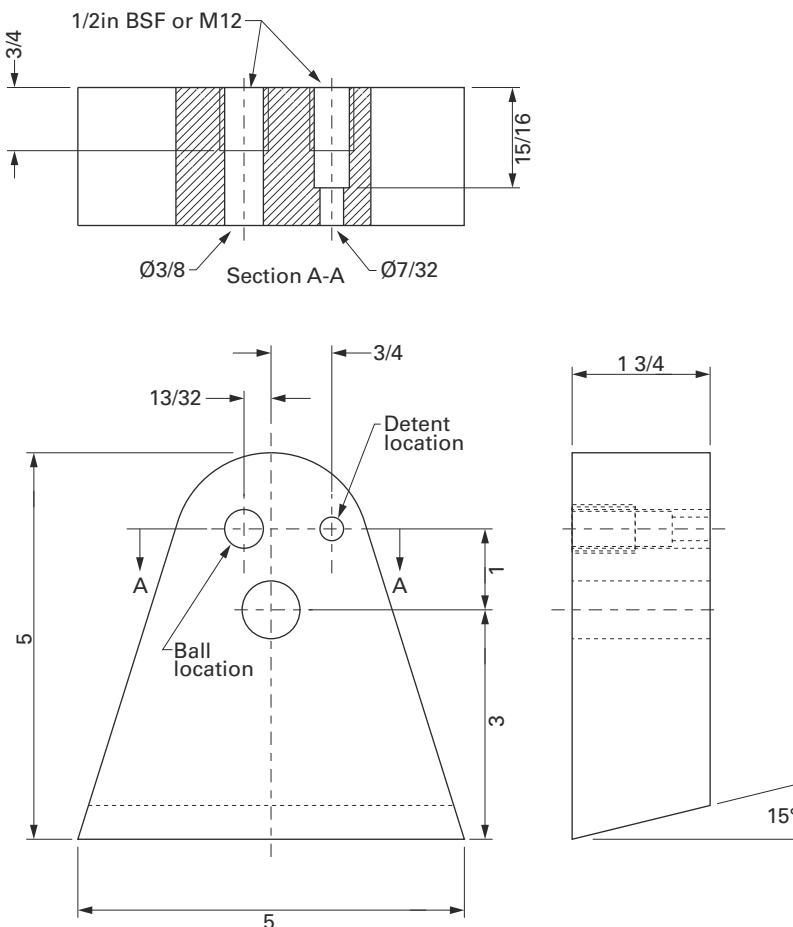
The detent hole was drilled and tapped to suit whatever size ball and spring I found in the scrap box. I found that a 3/8 ball that suited and tapped the back of the hole M10. I discovered later that the ball and spring did not hold the position firmly so a positive spring loaded locking pin was added, as shown in **photo 2**. The position of the backplate on the base is best determined when the turret has been made and part assembled on the lathe, photo 1 shows the position that I used.

I marked the outline and drilled 3 fixing holes in the base, turned the base over and counterbored the holes for socket screws. I then repositioned the backplate to mark through, drill and tap it. The turret apron was made of 1/2 inch aluminium plate but could just as well be steel. The inch diameter holes can be bored to take bosses which are turned to be a tight press fit or they could be brazed in to a steel apron.

A pair of gears, 20 and 45 teeth, 20dp, were found in the scrap box to make the feed direction correct. When the bosses were pressed in, two holes 1/2 inch diameter were reamed to take the gears, the centre distance was 1.625/1.630, for the gears that I used, The fixing holes were now drilled and counterbored.

To drive the turret back and forth the handle and gears are as shown in **photo 3**. A 14teeth 14dp pinion was purchased from HPC Gears (HPC G14-14). The 14 tooth gear was bored to 0.5 inch diameter, the slot milled and the other end

Fig. 3



The rear of the turret tailstock.



The gears on the tailstock apron.

counterbored. The 45 tooth gear need a matching tongue machined in the boss.

To assemble the apron with its gears, I laid the base on the lathe bed and offered up the apron so that the 14dp pinion engaged the rack without backlash. I clamped it in this position and marked off the fixing holes on the base, so these could be drilled and tapped.

I then re-assembled the turret and with a centre drill was held in the chuck, all four positions were spotted, they were then bored according to the tooling to be fitted. The fittings for the arms are personal choice, I used two chucks screwed to the arms. They were cheap Jacobs chucks with unhardened bodies, and the holes for the chuck key quickly wore oval making it difficult to tighten the chucks properly, so they have been replaced.

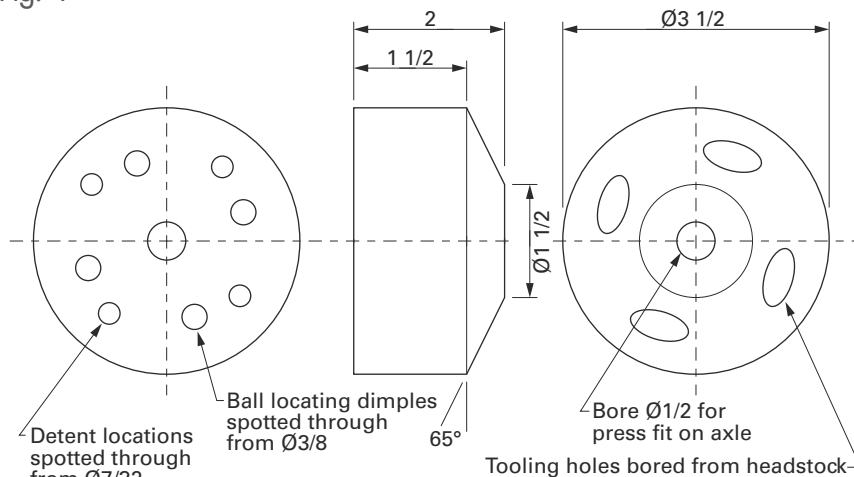
Another arm is bored to fit a $\frac{5}{16}$ Coventry diehead, my multi size die holder and a clutched tap wrench, each held from rotating by a pin through the bore fitting a slot in the shank and secured by a set screw. The fourth arm is fitted with a No.2 Morse taper socket with a shank, available from tool suppliers.

In a friend's workshop I found a device on a Harrison Lathe that released the clasp nut from the leadscrew when it hit a stop (an Ainjest unit as described recently by Andrew Johnston). This is very useful when making an internal blind end thread, but also speedier cutting any other thread.

I had to have a clasp nut release, even if it wasn't as sophisticated as the Ainjest. The first job was to turn the lathe upside down and secure a $\frac{3}{8}$ inch bar along the length of the bed to take a block that can be moved along it and secured by a socket screw, as shown in **photo 4**.

A niche was filed in the claspnut handle as shown in **figure 5** and a spring loaded

Fig. 4

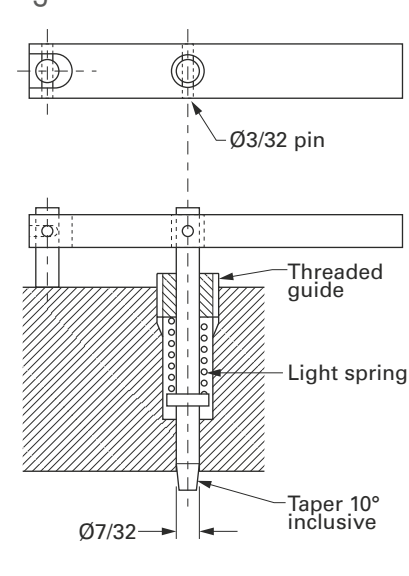


The stop bar of the leadscrew trip mechanism.

lever made to engage with it. When the claspnut is engaged it is prevented from disengaging by this lever. Another lever pivoted underneath the apron engages with the spring loaded one to operate it. A $\frac{5}{16}$ inch diameter rod is secured under the bed. When about to screwcut, move the block along the rod to the spot where you want the claspnut to disengage, engage the claspnut but hold light pressure on it trying to release it. When the lever hits the block the nut disengages. **Photographs 5 and 6** show the nut disengaged and engaged.

Having a DRO on my mill, I thought how handy it would be along the bed for saddle and tailstock movements. Length measurements on the lathe are always a bit awkward, so I used a long digital readout scale fitted with two reading heads. This was fitted on the back of the bed with one head fitted to the saddle and

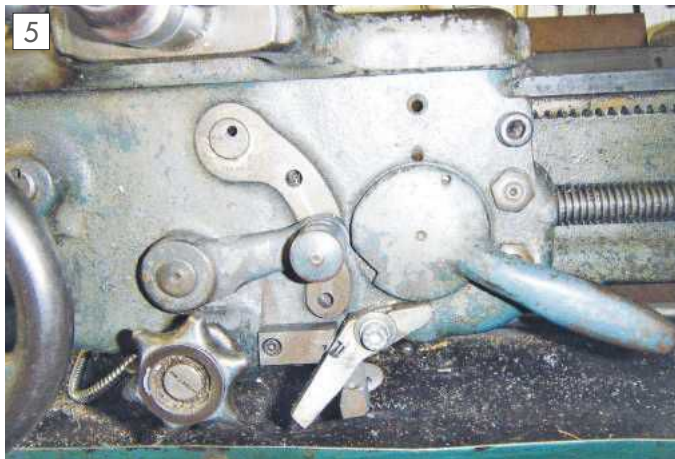
Fig. 5



the other to the turret. A two axis display is fitted to the wall behind the lathe.

Finally, one day the motor died. I discovered a new motor would cost more than the repair, so I bought a variable speed motor and inverter from Transwave.

And the future? I'm thinking a screwcutting gearbox would be useful... ■



The trip lever disengaged...



...and in the engaged position.



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Reconditioning a Pedestal Drilling Machine

Chris Smith uses some unconventional approaches to repair a machine that had a short, hard life.

I had the good fortune to have had a pedestal drill given to me by a friend. This drill was in need of some attention, having the following broken parts: the main spindle, the handle for lowering and lifting the table and the ring that held the lifting rack to the pillar. Cracks were also appearing on the cast iron base of the drill. Apart from these few problems, it also came liberally coated in white paint, as it had been dumped in a spray booth while waiting for its final journey to the scrap yard. From what I have just said, it would be hard not to jump to the conclusion that this drill has had a long hard working life. The truth is that it is no more than seven years old and that it had just been a jobbing drilling machine in an electrical repair firm. It has also never had taper shank drills used in it and the chuck only took up to 13mm drills. The chuck, which was the original one, was still in such good condition that it was removed and used in the newly purchased drilling machine that replaced it, this being better than the one that came with the new machine. The external state of the drilling machine can be seen in **photos 1 and 2**.

Before any cleaning work was carried out, the main spindle was removed so that I could assess what sort of a job I was letting myself in for. Would I be able to machine the parts, without a lot of expensive new tools? **Photograph 3** shows what the spindle looked like. The full extent of the damage at the number two Morse taper socket end can be seen in **photo 4**.

Figure 1 is taken from the original spindle and gives some idea as to the thickness of the steel, at the point where it had broken. Not wanting to make a bigger



The head of the drill as received.

job than I needed to, I decided to do a trick that my friend Sam has had a lot of experience and success in doing, admittedly on very large jobs; that is to shrink a new piece of steel onto the spindle, to replace the broken piece and thus avoiding having to cut the new spline end. At the same time I wanted to increase the thickness of the shaft, which meant fitting a bearing with a larger internal diameter, while keeping the same outside diameter. The original bearing number was KNK62042ZZ, which has a bore of 20mm, an outside diameter of 47mm and a depth of 14mm. The bearing that I replaced it with is a 6005ZZ, which has a bore of 25mm and an outside diameter of 47mm and a depth of 12mm. This meant that the bearing would not be as robust in some areas, but would have the same outside diameter as the one taken out. I did at one point think of making an adaptor to fit into the original bearing housing and protrude to take a larger bearing of 25 ID x 52 OD and 15 deep. This also would have involved lengthening the spindle, so in the end I



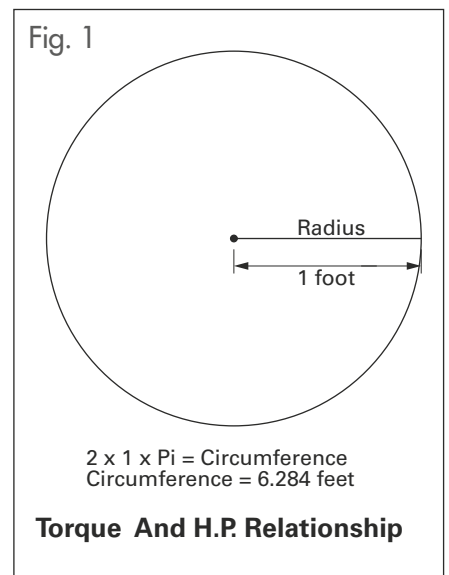
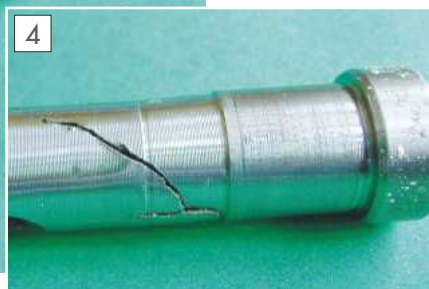
The base of the drill.

decided not to do this, but the ideas always there for any future modifications. The rough-cast hole through the bearing housing is approximately twenty seven millimetres, so the thicker shaft at slightly under twenty five millimetres would pass through without presenting any difficulties.



The damaged spindle.

A close up of the cracked area.

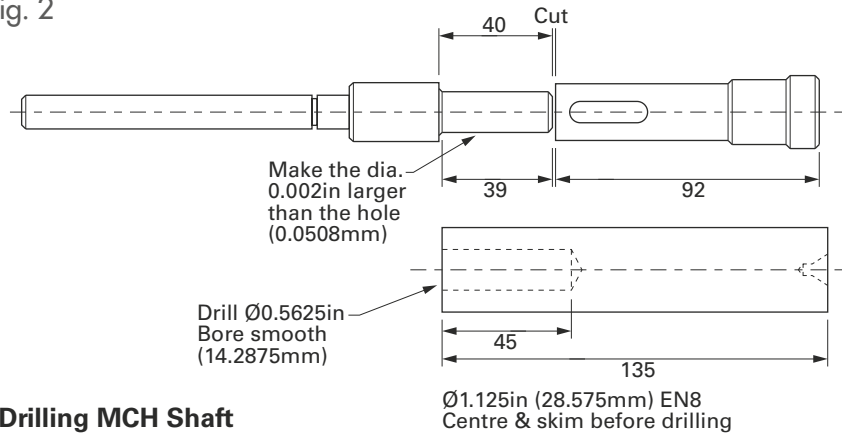




Three shrink fit test pieces.

Before preceding any further, I needed to know the tensile strength of the steel that the original spindle was made from. With the use of Sam's Brinell testing machine, I found the tensile strength to be 35 tons per square inch, and looking at how the steel on the original shaft has machined, I would put this as free cutting carbon steel. Looking in an old Firth Browns steel specification booklet, I found this to be given as EN8M, which is free cutting, and comes in a normalised condition of 35 tons PSI, approximately. It can if required be taken up to 55 Tons PSI by hardening and tempering. Not bothered about the free cutting steel, I decided on EN 8, which gives virtually the same specification as EN8M. The Brinell test only gives the tensile strength, and on critical work the steel would have to be analysed. For a shaft that is to be used for a drilling machine the tensile strength is all that is required, and even this was to be improved by making the shaft thicker. I have some bars of steel, which while I know that these are better quality than mild steel, that is all I knew, so I tested these at the same time, and picked out one of the bars that had a tensile strength of 35 tons PSI. This is black bar with a diameter of 1.125 inches. Before proceeding with the shaft, I decided to do a test on joining two pieces of steel together by shrinking. Before this can be done some calculations were needed, and this requires knowing the linear coefficient of expansion, per degree, for the material which is going to be used. For carbon steel the coefficient is 0.0000633 inches per degree Fahrenheit. The room temperature will have to be taken into consideration as all the steel to be used on the test should be at the same temperature. When shrinking two pieces of steel together, both the spigot and the wall round the hole will have to carry the full torque that the motor can deliver in the lowest speed. At the same time the spigot must not be too large, so as to leave a decent thickness of metal on the shaft wall, so the elasticity of the steel will give a good grip. Using a piece of the steel cut from the bar which was going to be used for the finished shaft, I drilled a 0.5625 inch hole up one end, to a depth of approximately 1.25 inches. The hole was then bored smooth and parallel and the diameter checked for size, this was now 0.600 inches. At this point a calculation on the diameter of the spigot is needed and this starts with having an idea as to what temperature the steel is going to be heated up to. This was chosen to be 640°F (light blue) the room temperature of 65°F was taken away from this to leave 575°F and the following calculation carried out:

Fig. 2



575°F x 0.6 inches
diameter x 0.0000633 = 0.00218 inches.

There is no need to use Pi. There is a lot of latitude in expansion, like the colour light blue that can be viewed differently. Also the steel can be colder than room temperature, which will give a greater difference when one of the pieces is heated. If the spigot is over size the work can be expanded to fit the spigot by getting it even hotter.

A piece steel of the same quality was turned down at one end, to a length of 1.5 inches, and to a diameter of 0.602 inches. The other end of the steel was turned down, and a nut welded on the end, see centre, **photo 5**. The bar was then held vertically in the vice, well clear of the vice jaws, with the end with the hole in it to the top. The end of the bar was then heated with a propane blowlamp to light blue, 575°F, and the test spigot dropped in. This must be done without removing the blowlamp and must be hot enough so the piece of steel drops straight in. The joint was then left to cool down naturally. If the steel has been heated beyond blue, it may take some time before it grabs hold of the inserted piece. Another tip is not to have any holes through the bar at any point where expansion is going to take place, or it will change the expansion rate at that point. The 130 lbs/ft bar with the fine hole at the top in photo 5, made me think I was going crackers. I held the lamp on till it was dull red and the spigot would still not go in. It was only when a sharp blow with a hammer took it through the tight rim that I realised the problem.

To check if it will be capable of standing the torque of the of the motor a the lowest speed, without the connection slipping, a small calculation was needed. For the person who is not conversant with foot-pounds and pounds per foot let me clarify the difference. While the two are linked together, both relate to a different operation, which is:

foot-pounds = Work
pounds/foot = Torque

Looking at **figure 2** it shows a circle with an arm at a radius of one foot. Now if it takes a pull of one pound, at the circumference of the circle, to turn the arm round the centre then it will have one pound/foot of torque. If it now does one

revolution at this torque it will have done 2π foot-pounds of work, which will be 6.284 foot-pounds..

The drilling machine electric motor has a power consumption of 0.37 Kilowatts, and a speed of 1420 revolutions per minute. One electrical horsepower is equivalent to 746 Watts, so to find the horsepower of the motor, first convert the Kilowatts to Watts and divide it by 746W:

$370 / 746 = 0.496$ Horsepower.
(Classed as a 0.5 H.P.)

One horsepower of work is equivalent to 33,000 foot-pounds. This work can be carried out over any time scale unless, like electricity, it is being charged for! Then it will fall under the Board of trade unit (B.O.T U) and 33,000 Foot/Pounds of work will then be carried out in one minute. So the ft-lbs of the motor is:

$33,000 \text{ ft-lbs} \times 0.496 \text{ h.p.} = 16,368 \text{ ft-lbs per min.}$

If a 0.496 h.p. motor does one revolution per minute, then the torque will be:

$16,368 \text{ ft-lbs} / 6.284 = 2605 \text{ pounds/foot}$

To find the torque for a 1420 rpm motor:

$2605 / 1420 = 1.835$

This is the full load torque.

The motor revolutions times torque remains constant, while whatever the motor is driving can have its torque, and revolutions changed, by the use of pulleys. The drilling machine has a bottom speed of 162 R.P.M. and this will give a torque on the spindle of the drilling machine on full load of the following:

$1420 \text{ rpm motor} / 162 \text{ rpm spindle} = 8.765$

This is the ratio of the revolutions, and increases the torque by the same ratio.

$8.765 \times 1.834 = 16.08 \text{ lbs/ft spindle torque}$

If the drilling machine spindle is increased above the motor speed, then the spindle torque, will be reduced lower than the motor torque, for example say the spindle speed is increased to 3000rpm.

1420rpm / 3000rpm = 0.473

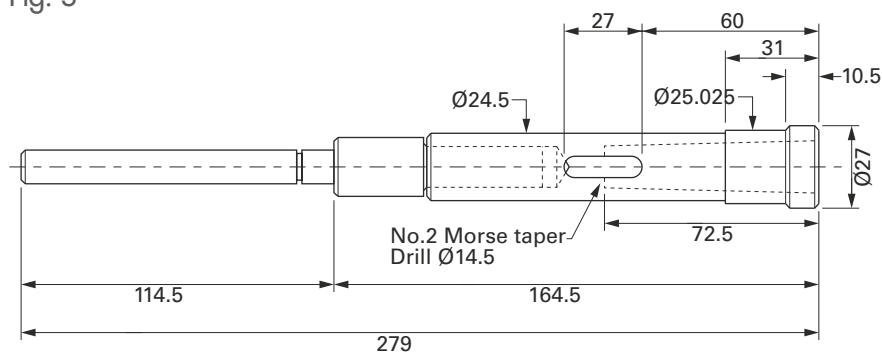
1.834 x 0.473 = 0.867 lbs/ft
spindle torque.

So, if the drilling machine is set to a spindle speed of 162 rpm, the shrunk on connection will have to stand 16.08 lbs/ft of torque. The test piece was clamped in the vice, and with a torque wrench on the nut, the torque was gradually increased till it reached 70 lbs/ft and at this point the connection moved. When it was then taken back below 65 lbs/ft it immediately gripped again. This was done a few times and each time it re-gripped, so at four times above the maximum torque required, it should not give any problems. On the final shaft, slight alterations were made to the depth of the hole, and to the spigot length, which put it more on the plus side. Photograph 5 also shows two more test pieces, one using the same diameter of body piece, while the other one has a slightly larger diameter. The holes were kept the same diameter and depth, while the spigot diameters were increased by 0.003 inches to 0.603 inches diameter, this meant increasing the temperature of the test piece. These were done just out of curiosity to see what sort of a drive, without slipping, could be achieved. The one slipped at 130lbs/ft, while the 250lbs/ft trial reached the limit of my torque wrench without slipping. In all of these tests, just to be on the safe side, a fine hole was drilled through the side of the wall into the bottom of the hole, to let the air out when the spigot was pushed home. This was just in case the bar had not been heated enough and the air prevented the spigot from going in.

Making the new part of the shaft

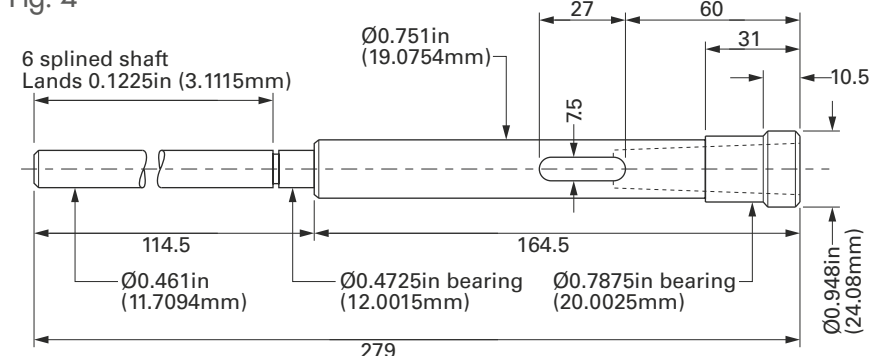
The piece of EN8 bar to be used, should be cut off to the length as shown in **figure 3**. Face and centre at both ends, and remove the minimum amount removed from the outside, just enough to clean it up. The hole in the end was then drilled, and bored smooth. A 3mm hole should be drilled through one side of the bar, into the bottom of the bored hole; this is to let the air out.

Fig. 3



New Drilling MCH Shaft

Fig. 4



Drilling MCH Shaft No.2 Morse Taper

Cut the old shaft at the point shown on the drawing, then clock up the piece to be used, in the four jaw chuck, with the rest of the shaft towards the tail stock, then check the small bearing journal, to see if it runs true to the main shaft. If the two are not concentric then clock up on the small bearing journal, and turn a register on the larger part of the shaft, at a point where the clock gauge can be put, when the splined end of the shaft is in the headstock. Turn the shaft round so the thin end of the shaft is into the headstock, grip the larger diameter in the chuck, and

clock up. Turn the spigot, making it 0.002 inches greater, than the hole in the piece it is going to be shrunk into. Shrink the two pieces together, as previously described. Return to the lathe and grip the thick part of the old spindle in the four-jaw chuck, leaving enough out of the chuck for clocking up. Machine the shaft to the dimensions shown in **figure 4**, making the main part of the shaft with enough clearance to let the bearing pass over it.

Where the bearing fits, the size given is only a guide and I just made the bearing a good tight push on fit. Remove the shaft from the lathe and make sure the bearing has gone right home. Before returning the shaft to the lathe set the compound slide up to turn an internal number two Morse taper (**ref. 1**). Return the shaft to the lathe and put the steady onto the outside of the ball race so that it grips the outer ring, allowing the shaft to revolve using the ball-race. The centre is kept in the centre hole of the shaft while the steady is being fitted. Drill a 0.5 inch hole into the end of the shaft, to a depth to a depth of approximately 2.75 inches, this may have to be deeper if the boring tool tip is not right on the end of the tool. Also allow for any machining of the shaft to length, although this is not critical.

To be continued...

REFERENCE

1. A simple Approach to Taper Turning, C. Smith, *Model Engineers' Workshop*, issue 125, p.21.

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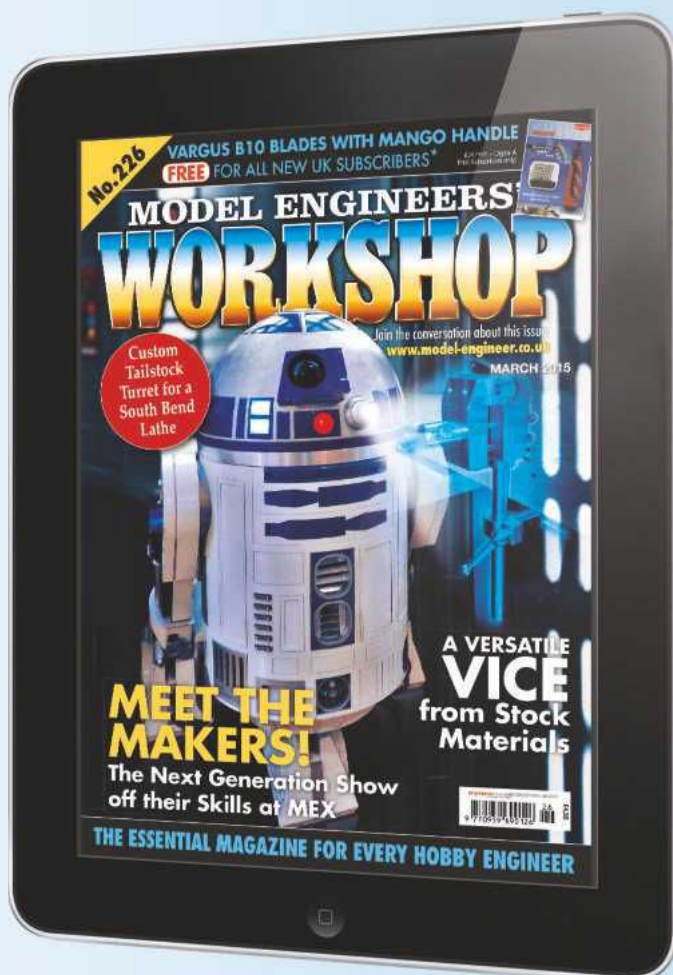
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Readers' Tips

This month's winning tip is from Lyndon Baugh who offers a rather different setting gauge for gear cutters. He wins £30 of Chester gift vouchers.



TIP OF THE MONTH WINNER!

Setting Gear Cutters

Don't despair! In the construction of my first clock I hit a snag, no matter how hard I tried I could not get the wheel cutter on exact centre height, resulting in several wheels with leaning teeth!

A search of the Internet brought up a rather expensive tool which for my setup would have been impossible to use. Taking a Heath Robinson approach the following item was made and has worked every time.

The gauge consists of two pieces of brass that clamp to the bed of my lathe. To use this, first ascertain the thickness of your wheel cutter. Turn an off cut down to a diameter equal to this thickness. Place jig on lathe under turned bar, tighten to bed, then slide adjusting bar up to touch underside of turned bar, and tighten clamping socket head screw. The jig is now set and can be removed carefully from the lathe.

Remove turned off cut and place and prepare clock wheel blank and initially set up your wheel cutter.

Now the magic! Replace the jig and clamp to bed. Lower wheel cutter down so that its bottom surface touches the top



of the sliding bar. Lock cutter height and check nothing has altered, if so adjusted, then you can cut your wheels with straight teeth!

I hope this is of use to someone.

Lyndon Baugh

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Email your workshop tips to **neil.wyatt@mytimemedia.com** marking them 'Readers Tips', and you could be a winner. Try to keep your tip to no more than 400 words and a picture or drawing. Every month we will chose a selection for publication and the one chosen as **Tip of the Month** will **win £30** in gift vouchers from Chester Machine Tools. Visit **www.chestershobbystore.com** to plan how to spend yours!

This month's runner up is Piet Vermaat in Luxembourg. He offers some ideas for holding awkward workpieces and gets a Workshop Practice Series book as a prize.

Get a Grip

If you don't have soft jaws to face a washer or any other thin object that can't be gripped in a chuck then the following offers some solutions to that problem.

Face a piece of scrap metal. For a washer you can leave a boss the size of the inside diameter that will centre it nicely.

Then attach the washer. Soldering it has the disadvantages that you have to heat the stub and the washer in the chuck and the materials must be suitable for soldering. Epoxy is also a possibility but the washer must be under pressure while it sets and it takes some time for it to have enough strength, and you have to heat it to detach it. Cyanoacrylate (super glue) sets much faster, almost instantly when an accelerator is used. Soaking in acetone will detach it easily.

Double sided tape could also be used, however, I have never tried it. Another possibility to clamp an odd sized object is to cast it in Woods Metal. The advantage is that woods metal melts in boiling water.

http://en.wikipedia.org/wiki/Wood's_metal

Piet Vermaat

Ed's note – Field's Metal is a safer alternative to Wood's Metal that is free of cadmium and lead, but it is more expensive. http://en.wikipedia.org/wiki/Field's_metal



CHESTER MACHINE TOOLS

No more than one prize with a value of £30 will be given each month. By entering you agree your entry can be freely published and republished MyTimeMedia on paper or electronically and may be edited before appearing. Unpublished tips may be carried forward to future months. You will be acknowledged as the author of the tip. There is no guarantee that any entry will be published and if no publishable tips are received a prize will not be awarded. The decision of the editor is final.

Fitting a Quick Change Toolpost



John Ashton adds a QCTP to his TOOLCO 1130GV Lathe.

Finding the correct combination of packing shims to position the tool bit to the correct cutting height can sometimes be a laborious and frustrating task. So I decided to replace the standard 4-Way toolpost, on my TOOLCO 1130GV Lathe, with a QC toolpost. However, when you buy tooling systems, which are manufactured to suit a range of machines, it will invariably require some form of modification to fit your particular model, which was the case with my lathe. I also wanted the ability to revert back to the standard 4-Way toolpost, if necessary.

The QC toolpost system I purchased can be seen in **photo 1**, ready for use.

It consists of the following components, which are all shown in **photo 2**:

- The main toolpost, with locking handle and securing stud.
- Two standard tool holders, one with a 'V' groove to hold round section tool bits.
- One knurling tool.
- One boring bar holder.

I also purchased two extra standard tool holders.

Assessing the modification requirements First, I removed the existing 4-Way toolpost (**photo 3**) to reveal the existing locating spigot and spring loaded stop (**photo 4**). The locating spigot is a one-piece machined component, mounted through the topslide from the underside. The locating spigot is 22mm diameter and the locking handle stud is 9.5mm diameter. The quick change toolpost has a through bore $\frac{9}{16}$ in. diameter, so it was obvious that the new toolpost would not fit the existing spigot.

Therefore, to retain the ability to revert back to the 4 way toolpost, I had to remove the existing locating spigot and replace it with a dedicated spigot nut to locate the toolpost and its securing stud.



Quick change toolpost ready for use.

Removing the 4-Way Toolpost Components

To remove the existing locating locking handle stud I had to remove the topslide from the cross slide. To do this, I first had to remove the two screws securing the topslide to the retaining hub plate, this enabled me to slide the topslide forward towards the chuck, free of the retaining hub plate (**photo 5**). Removing the spring loaded stop was simple, I just had to lift the pawl and spring out of the location socket (**photo 6**). Once this was done I could remove the topslide, together with its



Quick change toolpost component parts.



The 4-way toolpost.



The original fixing stud.



Compound/topslide during removal.



The detent and its spring.



Compound/topslide removed from cross slide.



Locating spigot/locking handle stud & dowel.

jib strip, to reveal how the location spigot is mounted into the topslide (**photo 7**). As can be seen in **photo 8** the spigot is a drive fit with a counterbored shoulder into the topslide and is prevented from turning by a spring dowel. To remove it I used a soft mallet to tap the spigot free of the topslide, I needed to reuse the spring dowel, so I tapped it free of the spigot (**photo 8**).

Fitting the Quick Change Toolpost

To fit the new toolpost, as well as manufacturing a new spigot nut (**photo 9**), I had to 'archive' the existing toolpost securing plate (**photo 10**), and modify the quick change toolpost securing stud.



Quick change toolpost spigot nut.



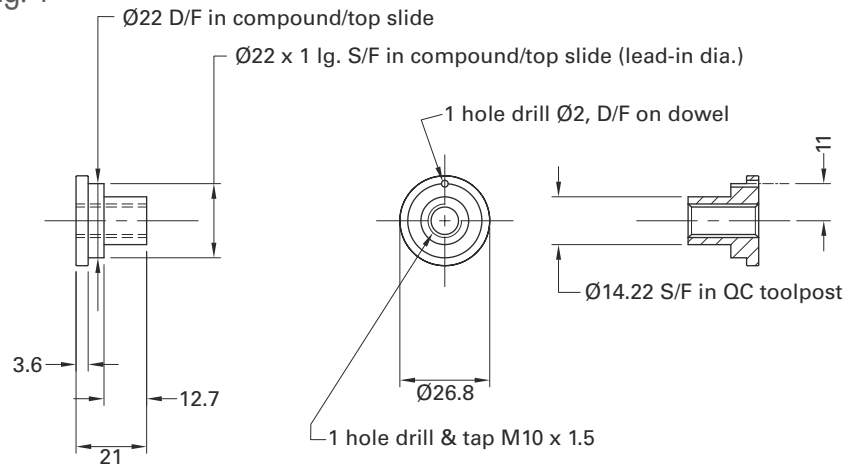
The securing plate, not required.

Manufacturing the Spigot Nut

I measured the 4-way toolpost locating spigot to obtain the spigot nut fit in the topslide, to this, I added a locating spigot to fit the new toolpost with an M10x1.5 pitch thread through the centre to mount the toolpost securing stud, full details are shown in **fig. 1**.

The first step was to turn the toolpost locating spigot diameter, the drive fit topslide locating diameter and the back shoulder diameter. The next step was to drill and tap the M10x1.5 centre thread to mount the toolpost stud. I tapped the thread, using my tapping head adapter (**photo 11**). I cut it off from the bar stock turned it around in the chuck and faced off to length (**photo 12**). The final step was to drill the hole for the spring dowel; there is no need to ream the hole, as the spring dowel will take up any irregularities. To drill the dowel hole I set up on my milling machine. After locating the centre of the spigot nut I moved across 11.0mm to the centre position for the 2mm spring dowel

Fig. 1



Spigot Nut
Mat'l: EN1A BMS



My tapping head adapter in use.



Facing off the nut.



Location for the spring dowel.



Threading the modified spigot.

15



The modified spigot.

hole. Care must be taken when machining the dowel hole, as it is only a half hole through the topslide drive fit hole diameter, which could cause the drill to wander (**photo 13**). An alternative machining method would be to machine a billet blank and machine the dowel hole prior to machining the location diameters.

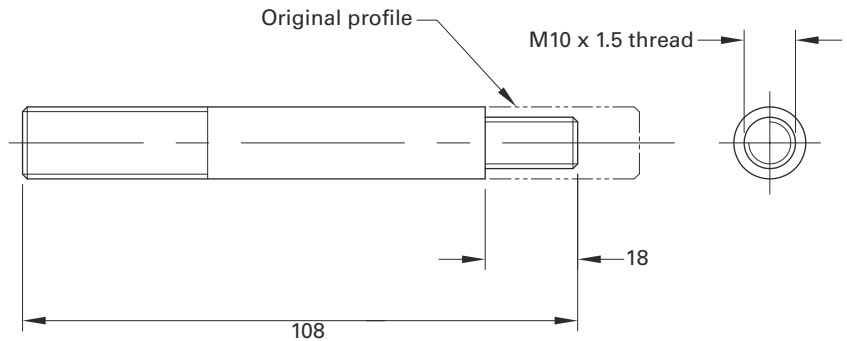
Modifying the Toolpost Securing Stud

The maximum thread size I could machine in the spigot nut to accept the securing stud was M10x1.5 (metric coarse). The existing



The nut with the dowel pin fitted...

Fig. 2



Modification To QC Toolpost Securing Stud

thread on the securing stud was M14x1.5 (metric fine) so I had to modify the Securing Stud to suit the Spigot Nut. To do this I had to reduce the length of the Securing Stud and cut an M10x1.5 pitch thread as detailed in **fig. 2**. **Photographs 14** and **15** show the modification of the Stud.

Assembling the QC Toolpost

First I fitted the spring dowel to the spigot nut (**photo 16**), then I fitted the assembly into the topslide. I had to ensure when assembling that the spigot nut sat square on its lead-in diameter and the dowel lined up with its location. I then tapped the nut fully home with a soft mallet, ensuring that the base of the nut cleared the top of the



...and located in the topslide.

topslide lead screw nut (**photo 17**). Next I repositioned the topslide and its jib strip onto the cross slide, ensuring the jib strip was positioned the correct way round, as it has location detents in one face to line up with the clamp screws (**photo 18**). I slid the topslide back in contact with the retaining hub plate then refitted the two securing screws, readjusting the jib strip clamp screws as required. All that was left to do was to fit the securing stud to the spigot nut (**photo 19**), position the quick change toolpost, fit the nut and tighten, 'job done'!

In Conclusion

I realise that the detail of this modification is only relevant to my particular model of lathe and other similar models produced by other Suppliers, but hopefully it will give *MEW* readers an insight into how to go about modifying their particular model, if they are considering changing to a quick change toolpost system and saying goodbye to all those bits of packing shim you can't find next time you want to use a particular tool bit. ■



Compound/topslide jib strip.



Toolpost securing stud assembled to spigot nut.

A Day in the Workshop

Laurie Leonard uses a few productive hours to make some simple accessories.



Do you ever have days in the workshop when you think, 'where did the day go?' and 'what have I got to show for it?' I had one such day recently and outline below how it went. The sum total for the day was four T-slot nuts and a chuck adapter.



The completed 'T' nuts.

The starting point

My current project is a Woden tool and cutter grinder being made from a Hemmingway kit. Having had some trouble with play in my pillar drill I decided to treat myself to a new one. After much deliberation I chose one with a larger throat, greater travel, a Morse 2 taper spindle and a rack and pinion table height adjustment. The machine was described for use by engineers and came with a T-slot table. Here was the route of the problem. I did not have any T-nuts that would fit, so I decided to make some.

Material

Having worked out a rough size I then checked my stock of mild steel strip and found none of a suitable cross section. The scrap box was then checked which in my case meant going through four heavy biscuit tins but this did not yield any suitable material. Back to the stock. My stock consists of several bundles purchased so that when a project such as this turns up I would have something to make it from. After checking and double checking I found the nearest suitable material and cut off four pieces. Normally the stock would be chosen so that the four T nuts could be machined in one strip and then separated. Due to the limitations of the stock in hand I had to machine all four separately with the corresponding time penalty.

Design considerations

A while ago I purchased a hold down set which comprised of various lengths of studding, strong backs and serrated wedges. In an inspirational moment I thought that it would be good idea to make the threads in the new T nuts the same as the studs so all the accessories could be used. Good idea but what was the thread? After checking with some known metric and British threads and then



The chuck spindle extension.

using a thread gauge and vernier I finally identified the thread and luck was on my side: I actually had a tap of the correct thread and size.

Drilling

This is a good one: part of the chicken and egg scenario. How do you hold down the vice to drill the T-nuts that will hold down the vice? After some improvisation the vice was secured and the tapping drill found. I mentioned that this was a new drilling machine. I had driven the chuck taper into the spindle using the method I was taught at school (yes I actually did metalwork at school); place a block of wood onto the table, insert the chuck into the spindle and lower the spindle until chuck presses down on the block of wood and is driven into the spindle. Releasing the pressure it promptly fell off and rolled behind the stand supporting the drilling machine. The stand could not be moved as it was too heavy so time was spent with various pieces of wood and a torch fishing it out from underneath. Fortunately it did not seem to have suffered as a result of the fall. The chuck was replaced, the jaws retracted and it was given a tap on the end with a copper faced mallet.



Tang Comparison and chuck removal drift.

The nuts were drilled tapping size and two nuts tapped. The hunt was then on to find two bolts to match the new nuts. None long enough were found so the other two nuts were opened out to the next metric size and marked with an 'M'. So much for standardisation (photo 1).

New nuts in use

With the nuts made and the day drawing to a close I thought that I would carry out a small drilling job with the new machine and newly secured vice. Having selected a 2mm drill bit I had trouble securing it in the chuck and then I remembered that the chuck had a range of 3 – 16 mm. All was not lost. I had another chuck with a Morse 2 shank that closed to 1mm so the new chuck was removed with the drift and the old chuck offered. Peering through the drift opening in the quill shaft I realised just in time that the old chuck did not show and that if I pushed it home I would have no way of getting it out. I had previously drilled and tapped the chuck shank for a draw bar so a piece of studding was cut to insert in the chuck spindle to extend it. The studding was reduced at one end to cater for the tapered bore in the drilling machine spindle (photos 2 and 3) and sized so that the drift could be used to remove it from the taper. ■

A Tommy Bar



Stub Mandrel makes a tommy bar.
If only everything in life was this simple.

Surely there is nothing simpler than a tommy bar? Probably not, but if a properly fitting tommy bar is not to hand there is always a temptation to use anything of approximately the right size. This brings several hazards – the wrong size or shape (hands up anyone who has used an Allen key as a tommy bar?) can damage or bruise the hole. Too long a bar can impose undue stress. A handy length of brass or mild steel might do the job just right – then return to the scrap bin with a bend that doesn't become apparent until you need it for some other job...

Far better to have a well fitting, appropriately sized tommy bar for every job. I won't instruct you on how to make such a bar. I do suggest that you finish the bar nicely though, so it doesn't look like any old scrap bar end and get used for something else or thrown in the scrap bin. For most steels blacking by heating to a dull red heat and dropping in oil (carefully and outside please!) will do a good job.



The photos shows a bar I made to suit a number of tools, including a collet chuck. One end is slightly reduced so each end fits different sizes of hole. It's made of stainless steel so it is quite strong, but this makes it impossible to black, so instead I wrapped it carefully with rings of insulating tape. While this lasted a couple of years, it eventually started to peel off. When I get around to it, I will replace this with heat-shrink tubing as used in electronics. Just thread a length over the centre of the bar and warm it with a hot air gun (or a small gas flame from a suitably cautious distance!)

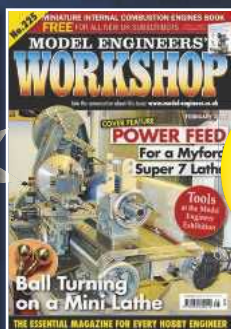
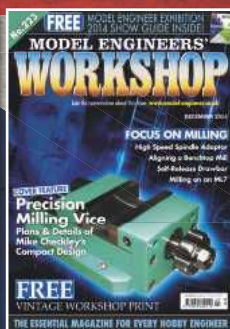
On some occasions, such as small vices or clamps, a captive tommy bar is a suitable solution. Neat upsetting (forging to greater diameter) of the ends of such

bars is beyond my skill and simply flattening the ends (as is often done on cheap g-clamps) looks naff. A neater solution is to make the bar a good fit in its hole and use a centre punch to raise two hollow spots at each end of the bar. These are surprisingly effective at stopping the bar from slipping out, and make an excellent solution for small clamps. Finally, the deluxe solution. I discovered this when replacing the leadscrew on a small machine vice – the ends of the tommy bar appeared to be riveted neatly in place. In fact, a ring of metal was held by a force fit at each end of the bar. This is a very neat way to put ends on a bar, but it does depend on your ability to turn the right fit.

Crikey! What a lot to say about a simple metal bar? Still, the late George Thomas always advocated taking the greatest care with even the simplest of jobs – only that way can the skills to undertake really first class work be attained. ■

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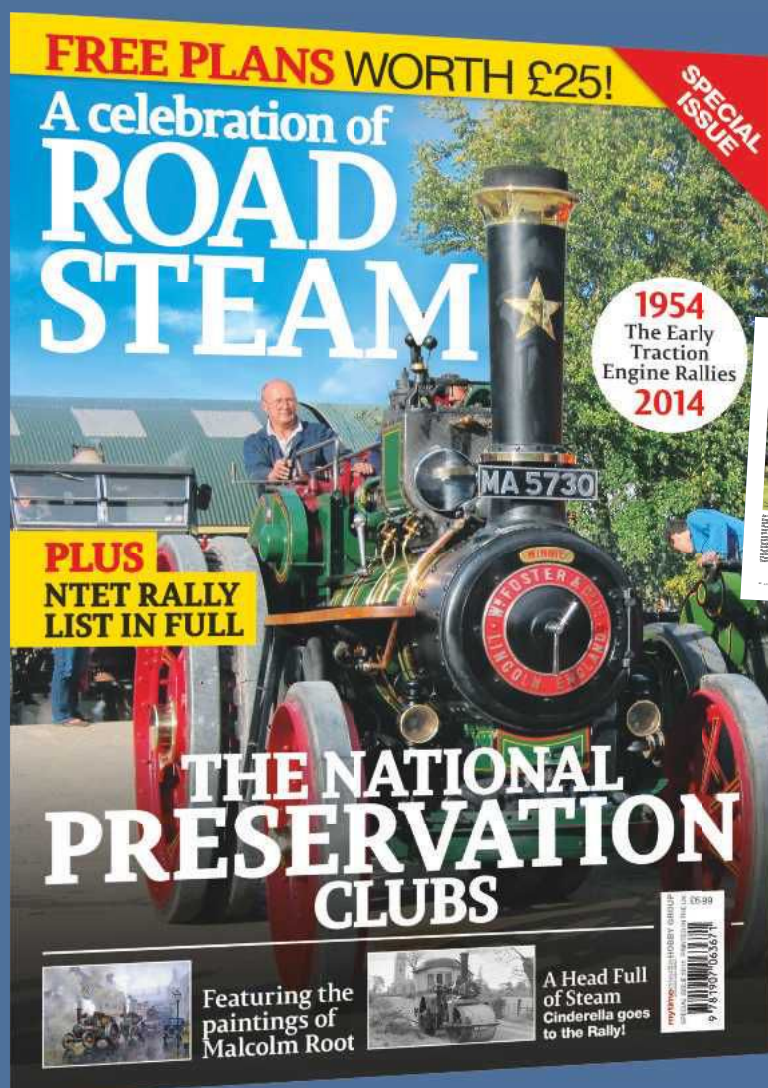
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Workshop Tools

at the Model Engineer Exhibition Part 2



MEW Editor, Neil Wyatt, continues his report from the Model Engineer Exhibition at Sandown in December, with a focus on the 'Makers' and the SMEE.



As I live well north of Brum, I was delighted that the role of editor gave me the excuse to spend two days at the Model Engineer Exhibition. I found almost as many new things on my second day as the first, and still didn't get to see as much of exhibits like the Stirling Engine Society and the full size traction engines as I had wished. My focus was naturally on workshop tooling and so I'd like to pass on some of the flavour of the exhibition to readers.

Meet the Makers

I did worry if the Maker Area would be a backwater at the exhibition – quite the contrary, it was absolutely buzzing for the whole show with objects printing, whizzing around (**photo 23**) and making music while the 'makers' and model engineers got to know each other. There was some very nice kit on display, including a CNC cutter with a hefty 40-watt CO2 laser (**photo 24**) – please do NOT look into the beam! Another stand had fascinating hydraulic sculptures worked using syringes and this neat pop-up phone stand from a single bit of MDF (**photos 25 and 26**).

One thing that struck me was the increase in the quality of 3D printing (**photo 27**). With 0.1mm layer thickness now a minimum standard, things are really moving. I especially liked the look of the Printerbot machine (**photo 28**), which has an entry level price, yet has the



Tiny robotic buggies in the maker area.



A hefty 40-watt laser.



Just press from underneath...



...and this is a phone stand.



Some more engineering focused items of the many 3D printed objects on display.



Printerbot 3D printer.

rigidity to produce quality output. As an example of just what can be achieved was some beautiful jewellery, created by scanning in some Japanese script, printing it and making a lost wax casting (**photo 29**). Lost wax castings from your own STL files in almost any metal are now a reality – I hope to carry an article on how to get this done soon.

There were plenty of projects on display that used 3D printed parts. One of the most impressive was the prototype Pi-Top computers (**photo 30**). This crowd-sourced idea has already hit 217% of its target, so it will be available in a few months.

These laptop computers use a raspberry-pi (the incredibly cheap but powerful single board computer) inside, with a Linux operating system. Various add-ons called Pi-Top HATS (sic) include a standard one that gives the Raspberry PI HD video and the computer a full-size screen, others are available for robotics and home automation. The designers said that in the future it will be possible to use an Arduino or other single board computers within the overall package. This could well be an interesting route for anyone seeking a computer to control their CNC equipment. More information is at pi-top.com.

A simpler idea with a printed shell is the 'cannybot', tiny little line following robots with a difference (**photo 31**). These go



3D printed and cast jewellery.

fast and when they, inevitably, fly off the line, you can use an app on your phone and drive them back onto the course! There was huge interest in these tiny 'bots' which are supplied as a kit with laser cut and printed parts. Like all the maker projects, these are not made in some factory, but developed and made in home workshops and kitchen tables.

Another aspect of the maker approach is to 'hack' existing products (makers

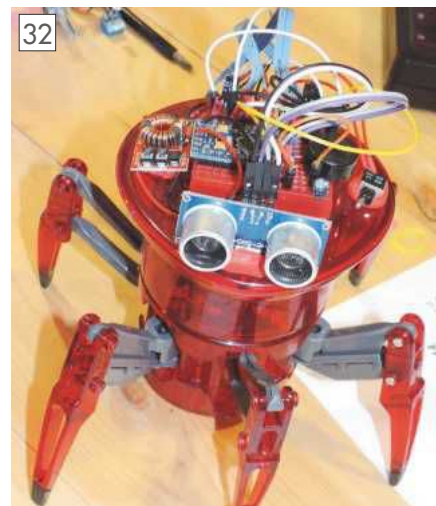


The Pi-Top laptop computer.

often call their workshops a 'hackspace'). One fun example of this was a many-legged toy robot that had ultrasonic sensors fitted to make it autonomous (**photo 32**). On the other hand, many makers like to build their robots from scratch, and a very popular subject is R2D2, the Star Wars droid. A full size example was present and toured the whole exhibition visiting the various stalls and displays (cover photo). A vast



The Cannybots on their course.



A multi-legged robot with an ultrasonic upgrade.

range of materials are used in robot making, from metal through plastics to wood, but the majority of skills used are very much those used in a traditional hobby workshop. Like many make projects, there are dedicated websites and forums to support the builders.

One maker display I really enjoyed was a young chap from the Royal College of Music who makes instruments from recycled materials. Although the listening facilities were a bit limited, the various instruments made distinctive sounds (**photo 33**). Although some were based on traditional ideas, one made from an assortment of springs, magnets and transducers would surely have been a favourite with the BBC Radiophonic Workshop it had been available back in the seventies. Search the net for Vulpestruments.

The SMEE Stand

The Society of Model and Experimental Engineers deserve a particular honourable mention, as they had a host of things happening, including big display of steam engines running on air (**photo 34**). Tooling wise, there was an excellent collection of George Thomas' designs to inspire us (**photos 35 and 36**). An exhibit that produced sound, light and a little movement was a demonstration spark erosion machine (**photo 37**). I just had to have ago and found it was capable of making a $\frac{1}{16}$ inch hole through a Stanley knife blade in under a minute (**photo 38**). This suspiciously analogue exhibit was just one of many electronic projects on the 'digital workshop' display, most of which involved embedded



A selection of musical instruments fashioned from recycled items.



Running steam engines on the SMEE stand.



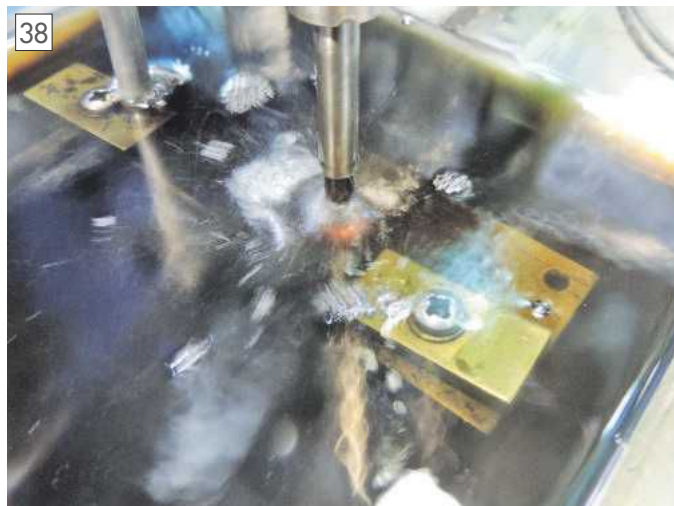
Larger tools to GHT designs...



...and a selection of smaller ones.



37 Demonstration spark erosion machine.



38 The business end of the eroder.



39 First steps in scraping.

microcontrollers. Not everyone's cup of tea, but one of my own areas of interest. At the manual end of things, Neil Read was offering tutorials in hand scraping. I had a go and the blue spots moved around (**photo 39**), although I'm not convinced I made the surface any flatter.

Naturally, no exhibition would be complete without a Quorn tool and cutter grinder, Allen Borman had brought his nicely restored example along (**photo 40**). Next to it was another quorn, with which Joerg Hugel was demonstrating his approach to grinding twist drills – something that Professor Chaddock had given up on! The demonstration included a massive drill bit in a test jig, just to prove what the Quorn is capable of (**photo 41**). Also on the SMEE stand was a nice example of the old meeting the new, a Boxford shaper matched to a Division Master equipped rotary table that was happily generating internal gears (**photo 42**).

I should also mention the SMEE lectures, these were well-attended, with dozens of people in the audience for each one (**photo 43**). Topics covered included 3D printing and motorcycle restoration.

Thanks to all!

I found the show both exhilarating and inspiring. I'd like to echo Mike Chrisp's thanks, given at the prizegiving, to Mike Law and Steve Eaton for their huge efforts to organise the event as well as all the judges, stewards, entrants, clubs and exhibitors and MTM staff who helped make it happen. I'd also like to thank the one person Mike didn't – himself!

I look forward to meeting you at next year's show! ■



40 A refurbished Quorn.



41 A drill accurately ground on a Quorn.



42 Shaping an internal gear.



43 A SMEE lecture on 3D printing.

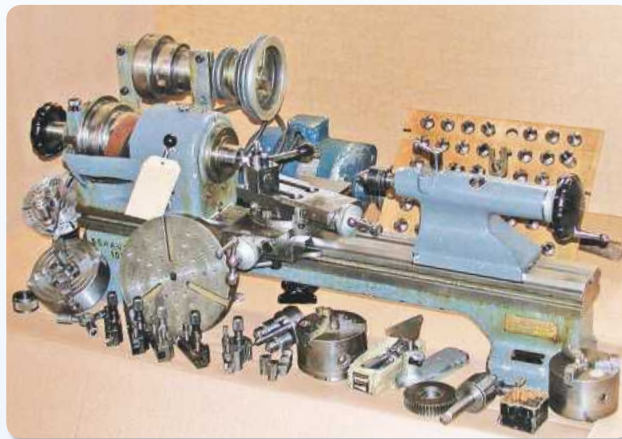
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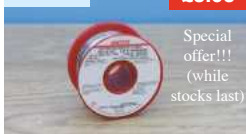
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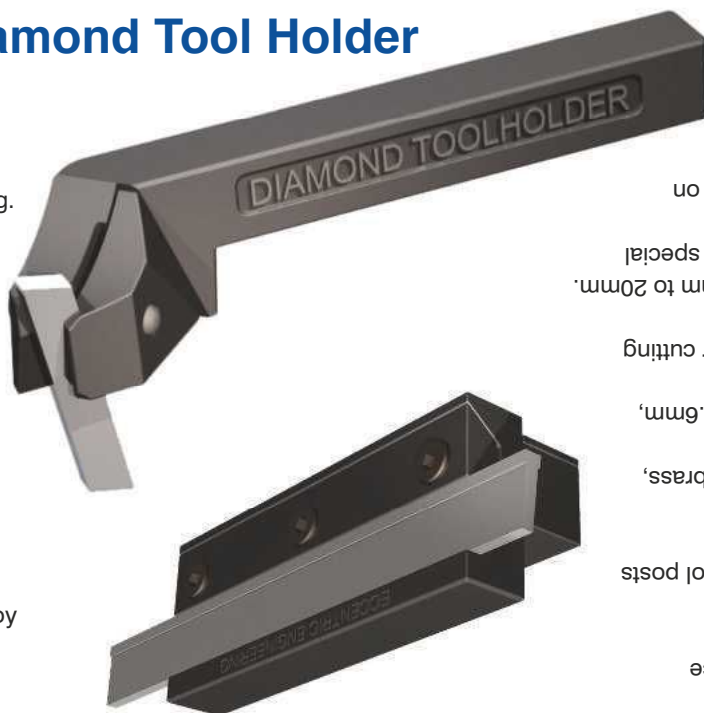
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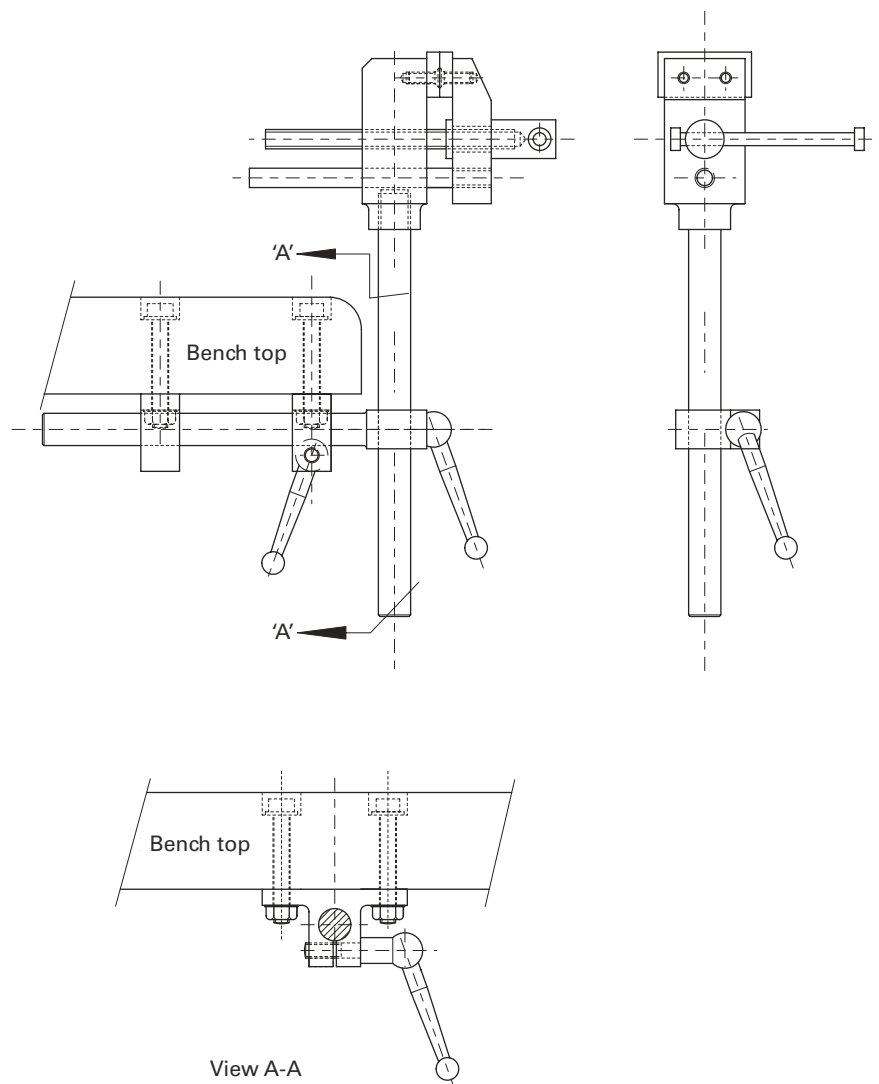
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**The For Inverted Parting
Tool Holder**

The motivation for this project was, I'm afraid to admit, advancing years. I'm at the valve gear and regulator stage of building an eighth scale Allchin steam traction engine and deep into the little fiddly bits. The difficulties of holding and manipulating small parts is an on-going problem and using a headband magnifier in place of good eyesight plays havoc with the back with all the bending. This little device is fixed to the bench and holds those small parts securely at a level where I can sit down, get close enough to use the headband magnification in comfort and will rotate in two planes to do all of those time consuming but accurate filing and polishing jobs.



Fig. 1



A Useful Mini Vice

Brian Moseley describes a small angle vice made from stock materials.

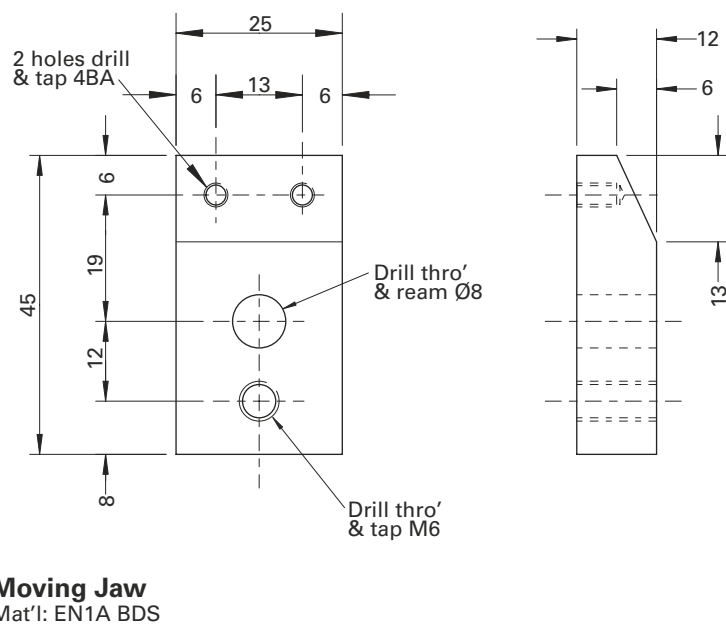
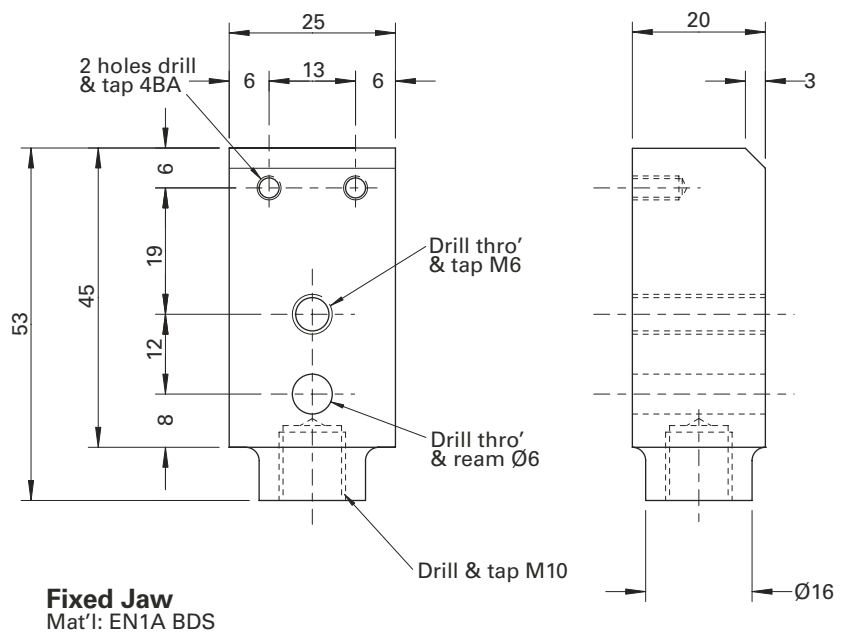


Most of the material for this project came from off-cuts in the 'box under the bench' and is mainly EN1A free cutting mild steel. The only exception to this is a short length of 6mm silver steel for the guide bar and a couple of small bits of aluminium flat for the jaw plates. Let me say right at the outset, that although the drawings are all metric, if all your material turns out to be imperial sizes then nothing is lost by using it, and an inch wide in place of 25mm will make no difference what-so-ever. As can be seen from **photo 1**, the finished vice, and the general arrangement drawing (**fig 1**) the vice is bolted to the bench top. The two brackets are a permanent fixture on the underside of the bench top, and as such don't get in the way of other things, whilst

I am never really very happy with this sort of intermittent cut between centres. An altogether better way in my view is to mount the four jaw chuck and grip the work piece at the boss end with the revolving centre in the opposite end.

It's probably best to start with these; the two biggest lumps of the whole project (**fig. 2**). Start by preparing the two blanks to size. This can be done by any combination of sawing, filing and/or milling dependent on the material sizes you start with and the equipment to hand. If you are cutting them out of oversized bright bar be sure to remove any waste in equal amounts from each opposing side of the piece. If you leave one side 'as drawn' and remove all the waste from the other side distortion from the skin stress may at some stage cause problems. As part of this preparation mill or file the top edge chamfers shown on each item. It is obviously more satisfying if the two blocks are true and square all over but some minor discrepancies here will make little difference to functionality. The crucial thing with these is that the two opposing faces, to which the jaw plates will fix, are flat and 'bed' to each other nicely and that the 25mm width of the moving jaw is a 'whisker' smaller than the same dimension on the fixed jaw. Get the front and back faces of both jaws as parallel with each other as you can.

Fig. 2



are flush with each other and be careful not to cover the guide bar hole position with the clamps. Drill through both jaws 5mm diameter at the guide bar position into the brass. Taking care to maintain the position of the drill spindle relative to the clamped up jaw plates, use an M6 tap in the drilling chuck to then 'hand tap' the hole in the moving jaw. If the taper end of the tap just starts to enter the fixed jaw this doesn't matter; (but not too far). Maintain the grip on the fixed jaw, remove the clamps on the moving jaw and then, by hand, run the M6 tap through the hole to ensure a full thread

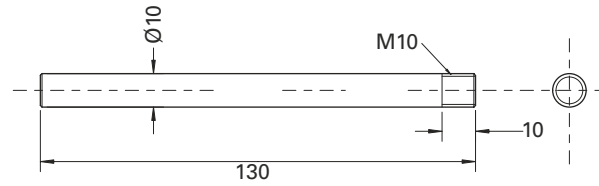
right through. Don't disturb the alignment of the drill spindle with the fixed jaw which is still clamped in the machine vice.

Open out the 5 mm hole in the fixed jaw to 5.7mm diameter and, using a machine reamer in the drill spindle, carefully ream through 6mm diameter into the brass. Maintain the grip on the jaw and clean out the now 6mm diameter hole and remove any burr on the top corner. Take a short stub of 6mm diameter silver steel, 32mm long and thread one end M6 by 12mm long. From a purist point of view the most accurate way to make this is to grip it in a collet chuck and screw cut the thread in the lathe. I used a die in a tail stock holder for this without any problems but there is always the risk it will not be truly concentric. Screw this stub guide bar into the tapped hole in the moving jaw and tighten. Replace this jaw on top of the fixed jaw inserting the stub guide bar into the 6mm hole in the fixed jaw. If everything has been done carefully it should slide home nicely and the sides of the moving jaw should still enter between the faces of the machine vice without any shake. If they don't and there is any slight interference a touch with a file should be all that is necessary to get the two mating faces to sit tight with each other. Re-clamp the fixed jaw down to the drill table and, with a centre drill in the chuck, line up the drill spindle onto the centre punch for the lead screw hole.

Drill through both jaws 5mm diameter, (into the brass), then drill through just the moving jaw 7.6 diameter. If the drill just chamfers the top of the 5mm hole in the fixed jaw that's perfect. Using a tap in the drill spindle, 'hand tap' the lower hole M6 right through then, using a machine reamer, ream out the upper hole in the moving jaw to 8mm diameter. That's it! Both jaws can now be removed from the set-up and cleaned up. Later, when the locking sleeve and the lead screw, have been made the two jaws can be locked together and the side faces and the top finished flush with each other and polished up.

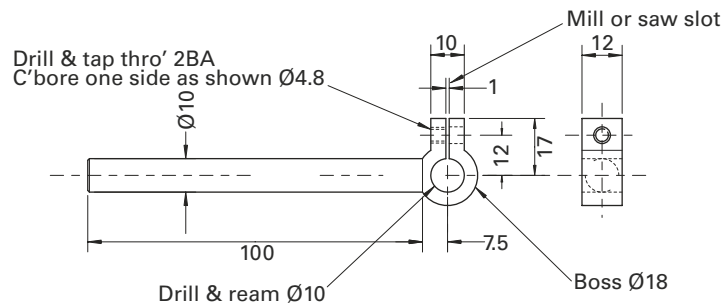
Photograph 2 shows the set-up for turning the 16mm diameter boss and drilling and tapping the M10 hole on the bottom of the fixed jaw. These two operations can only really be done in the 4 jaw chuck. Set the fixed jaw to run true with opposite sides equidistant from the lathe centre line. This is a bit fiddly but not difficult; it can be done with a dial gauge if you're a bit pedantic about these things but I set mine up using a short length of bar mounted in the tool post and winding the cross slide in to just touch the side of the jaw and noting the cross slide dial reading. Rotate the jaw through 180° and adjust the opposing jaws of the chuck until the dial reading is the same for both sides. Repeat for the other two sides. If it's not dead perfect, nothing is really spoilt. Turn the boss and gently drill the blind hole 8.5mm diameter. If you can, 'flat bottom' the hole with a D bit or pin drill this will help with the tapping operation. It is important that the hole stops well short of the previously reamed 6mm guide bar cross hole. Any distortion of this hole from the drilling or tapping at M10 will interfere with the free sliding action of the guide bar. Even putting the 6mm reamer through again may not restore the hole to its correct size.

Fig. 3



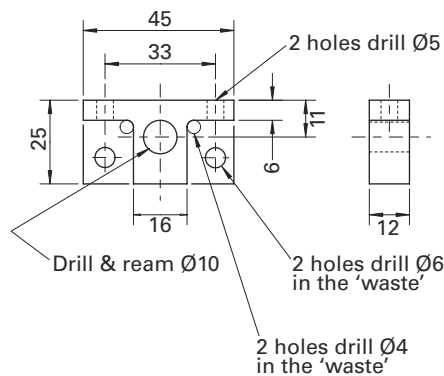
Vertical Spindle

Mat'l: Silver steel or EN1A BDS



Horizontal Spindle

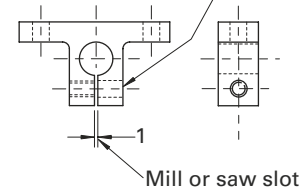
Mat'l: EN1A BDS



Rear Bracket

Mat'l: EN1A BDS

Drill & tap thro' 2BA
C'bore one side as shown Ø4.8



Front Bracket

Mat'l: EN1A BDS

Details as per rear bracket UOS



Tapping the boss.

Jaw Plates

Before we can finish the jaws it's a good idea to make the jaw plates and then spot through these for drilling and tapping the 4BA holes. These are a fairly straight forward job and, if you have the right thickness aluminium plate, simply need cutting to size and cleaning up; see **fig. 4**. Unfortunately I only had 6mm thick plate to hand and had to reduce this to 4mm thick on the miller. **Photograph 3** shows this simple operation clamped in the machine vice. Once the plates are to size, mark out, drill and countersink the holes in each jaw plate. The purpose of these being made from aluminium is to prevent any marking of the work piece when the Mini Vice is in use. I have used aluminium soft jaws in my bench vice for years and it works well from this point of view. They are likely suffer a fair amount of distress from wayward filing etc. and replacements will be needed at some stage - you could make a spare set while you're at it but I must confess I didn't.

Once these are finished mark out one corresponding hole on the inside faces of each of the mini vice jaws. Centre-drill, drill 3.0mm diameter x 6mm deep and tap 4BA - one hole in each jaw; be very careful not to break the tap, frequent clearing of the swarf is painstaking but is the right approach with these small diameter taps. Fix a jaw plate to each jaw with one 4BA socket-head countersunk screw and tighten, make sure the jaw plate is correctly lined up and spot through each plate for the second hole. Centre-drill, drill and tap as before. You will note that the drawing for the moving jaw shows these 4BA tapped holes as blind holes. That is much to be preferred but as you will see on photo 1, I over drilled and the holes came out on the front face. Functionally this is fine but it will look better if blind holes are achieved although the risk of breaking a tap is greater.

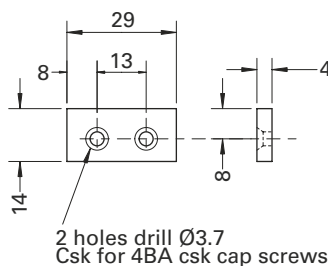
The Spindles

The Vertical spindle (**fig 3**) is very simple although this could be made in a variety of ways. Bright Drawn Mild Steel, BDS, is the simplest option with the end threaded M10 using a die in the tail stock. Silver steel will



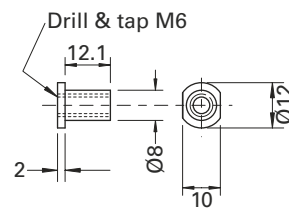
Reducing the jaw plates to 4mm.

Fig. 4



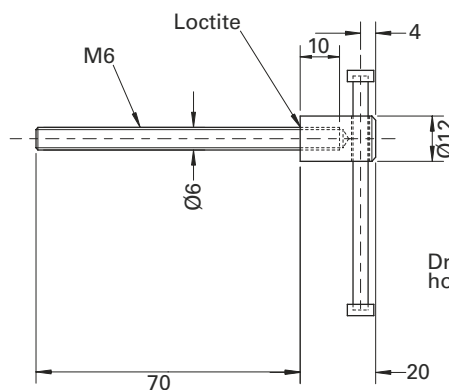
Jaw Plates

Mat'l: Aluminium, 2 off



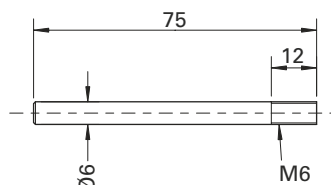
Locking Sleeve

Mat'l: EN1A



Leadscrew Assembly

Mat'l: All parts EN1A BDS



Guide Bar

Mat'l: Silver steel

give a more accurate result and a precise fit in the horizontal spindle although the threading will be slightly more difficult due to it being carbon steel. Equally, if you don't have either of these, it's a simple turning job from whatever diameter bar you happen to have. If you go down this route the finish needs to be good and the sizing as accurate to 10.00mm diameter as is possible. However you choose to make it, adjust the length of the thread such that, when screwed into the fixed jaw, it tightens on the thread rather than onto the bottom of the tapped hole. This looks good and prevents any distortion of the 6mm guide bar hole. Not at this stage but at final assembly, a touch of Loctite 603, or equivalent, on these threads is a good idea.

To be continued...

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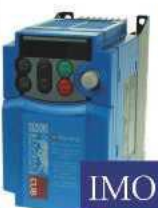
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Acid Test

Dear Neil, Regarding rust removal, as in the February issue, whilst clearing out the basement, I found a pair of simple wire strippers on the floor that must have been there from before I moved into the house, which was 10 years ago. They were very rusty, and seized.

After reading up on rust removal on the internet, and asking permission from my wife, I immersed them for 24 hours in 'white vinegar', in our case, branded cider vinegar, in a plastic tray from a takeaway, and then, since once cleaned they will rust if you so much as look at them, sprayed them with WD-40 and 24 hours later, with a white lithium grease aerosol. They now look pristine, they work properly, and I have added them to my electronic tool collection.

Geoff Theasby

Words

Dear Neil, In reply to David Piddington's enquiry about the word 'haridge'.

In the late 1960s and early 1970s I worked in a small jobbing engineering works in Yorkshire where the word 'haridge' was in frequent use. It was used in the same context as David suggested; to mean a sharp edge on a component. This could be on the end of a turned shaft where a burr had been left by the turner instead of a small neat chamfer. It was also used when referring to the rough edge left on the end of a piece of metal after having been cut off on a power saw, and to many other situations where a burr or 'arris' had been left. It was always common practise to make sure that every job was free from 'haridges' before despatching a job either to another worker for further processing, or to the

customer and woe betide anyone who didn't remove the 'haridges'.

So it would not appear that the word is confined to 'Brum Speak'. I have no idea about the correct spelling but, of course, being in use in Yorkshire it was never pronounced with the 'H' so it would have to be 'arridge', probably with the double 'r'.

David Earnshaw, 'uddersfield.

Super 7B Problem

Dear Neil, I wonder if your readers can help me with this problem.

My Myford Super 7B – some twenty years old, runs a taper on a test piece of some 0.005 to 0.007 inch over a five-inch length of round bar held in the chuck. An accurate levelling of the bed using an engineers' level helps, but not enough.

Super Six Success

Dear Neil, Thanks for printing my October letter and two of the photographs sent to you about my Essex Super Six Pacemaker's engine coolant thermometer. I was delighted to see the two replies in 225 – both giving useful information on which I shall act if I have to. However, in the interim I tried various things, with seeming success.

I found that the original bulb was too damaged to successfully re-assemble with hard solder so I turned another with a major modification – the main part attached to the micro-tube was turned copying the 9mm core and 11mm o/d in bronze from a length in my scrap box, and a separate end was machined from the same blank to make a robust socketed cap.

A 2BA thread was machined into that cap end of the bulb allowing fluid intake and subsequent calibration via a set screw and locknut assembly eventually sealed with Hylomar Universal Blue non-setting gasket jointing compound.

Using Fry's Superspeed G40/60 (melting point c. 237.77°C) plumbers solder, the two joints were successfully sealed after the copper micro tubing had been annealed and joints carefully cleaned and fluxed. Prior to this, I ran a very fine wire up the length of the bore but could not send it round the ultra-fine last bit of tubing into the phial. So, was it blocked? The soldered joints were scrubbed and flushed to remove acids and debris.

Suitable alcohol was extracted (using a straw) from the bottom of a very small bottle of deep-freezer chilled Absinthe drink (72.5% alcohol content, cost £3.50), 3.75cc of which was used with three drops of added red food colouring, then slowly injected into the open end of the upright bulb, no doubt with some migrating into the micro-bore tube – this made an excellently seen marker.

Hot water heating tests on a gas burner test rig in the workshop using suitable protective gear brought the fluid level eventually into the needed range; following only one correction of the screw and careful thread sealing with the gasket compound of both the screw and the locknut threads, repeated readings were gained with the essential 90°C consistently at the top of the V in the vertically scribed DRIVING Range.

Repeated success on the test bench – now to see if it will do the job in the engine. The melting level of the solder is a query



The new bulb with adjuster screw.



The test rig.

A successful test.

but I'm in real overheating trouble if I over-do 100°C!

The radiator is being professionally cleaned, checked and tested by a local specialist; I now need to back-flush remaining rubbish out of the engine block system and rebuild both the coolant gear and attend to some essential 6 volt electrical needs. Then, it's back on the road.

My grateful thanks to both J.E. Kirby and Tony Stark for their input – if need be I will act on their advice.

Eric Payn, Jersey

A 5-6 inch test piece held in the chuck but free at the tail end with alternate cuts as shown in the Myford handbook only improves matters by adjusting the screws underneath the bed and upsetting the levels as previously attained. Not a satisfactory solution as you will agree.

Peter Bryan, Saint Clement, Jersey

Motor Drives

Dear Neil, The article by Rich Wightman and Julian Harrison in Issue No.225 describes how a used windscreen wiper motor can be put to good use in the home workshop. It is good for the planet to re-use these 12v motors, which are surprisingly powerful, rugged and cheap. Can Julian be persuaded to publish his circuit diagram and parts list for the controller? Variable speed and reversibility would make them even more useful. My application is in grinding glass to make mirrors and lenses.

Brad Amos, Cambridge

You will be glad to hear that Inchanga, who has another article in this issue, has prepared an article detailing the construction of such a speed controller, aimed at those with little experience of electronics. Look out for it in the near future – Neil

Metal Master Screwcutting

Dear Neil, I am pleased that you have decided to make the readership aware of the very excellent Metal Master Machine Tool in the February issue. I remember reading about this in the article by David Urwick in *M.E.* No 3480 January 1974 (a copy of which I still have) and thinking that there could not be a more versatile machine available for the model engineer.

I was particularly impressed with the screwcutting system employed which featured the single tooth dog clutch on the headstock mandrel to ensure perfect pick up of the thread being cut every time even at high speed and without stopping the machine, except when checking progress. David mentioned in his article that this system was based on that of the EXE lathe which originated the method and which first became available during the 1920's.

Now by far the most detailed and informative article describing the working principle of this system is given in *M.E.* No 3557 March 1977 by Martin Cleaves entitled 'Screwcutting in the Lathe' which goes on to extoll its particular advantages and to describe how he modified his ML7 to use this system by the introduction of a clutch on an extended output spigot of the tumbler reverse. He also gives advice on the cutting of metric threads using this and of multiple start threads which it seems it can do with considerable ease. There are no construction details of his clutch mechanism given but the photographs are good and no doubt there are Myford owners out there who would be keen to try this excellent method and design their own clutch details to suit.

I have to say that given the superiority of the EXE system which provides totally



Paul Bridgen's lathe of unknown make.

The Mystery Machine

Dear Neil, I am writing to you from Australia with a long standing frustrating dilemma. Your ongoing feature "one man and his lathe" has finally prompted me to write! For forty years or so I have been trying to identify an old British lathe, which I have been using constantly over this time.

Over the years in *MEW* and *Model Engineer*, just about every lathe has been featured including the one I have. I had intended to contact Dave Fenner as I know he has knowledge of this particular machine, but I believe he is enjoying retirement (good on you Dave!!).

The only problem is that nobody seems to be able to categorically identify this wonderful little machine. I have been over the whole machine and there are definitively no maker's marks anywhere. The machine measures 3 feet 7½ inches by 4¾ inch centre height.

Two articles have been written with photos, one written by Dave, but to my knowledge there is still no identification. In your magazine the first author stated: 'This lathe is of quaint design but is strongly made and quite accurate, but differs from conventional lathe design, having two lead screws, instead of the normal tumbler gear system'. I believe Dave's article was titled *Small Lathes in Model Engineers' Workshops*.

I believe these machines were manufactured in reasonable numbers. There is at least one other here in Australia - it bobbed up on eBay and was imported from England. These machines have Whitworth threads throughout and every single part is numbered, my machine being No12. Myford, Drummond and Boxford etc. Are all very fine machines, likewise, I believe these machines are also excellent, there is not a single crude feature on them, with construction and finish second to none.

I am on the verge of retirement, and I'm sure 'NO NAME' is going to see me out, but before I pass her on I would dearly love to identify this wonderful machine, it definitely deserves it. In over forty years of service under my care, and I believe these machines are around the turn of the century, the only replacement from wear has been the saddle traverse spindle. After using this machine for this length of time, it saddens me that others know and have the same affection for their wonderful brands, I can only use and wonder!!!

Paul Bridgen



The apron of the mystery lathe.

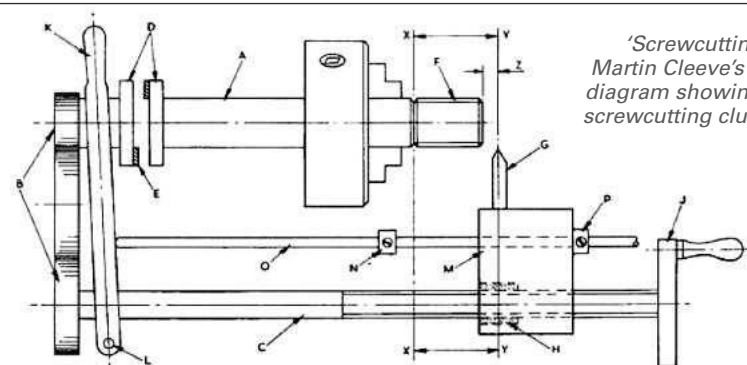


Diagram illustrating how a lathe can be designed (or modified) to give instant repeat pick-up for all thread pitches

Fig 1

'Screwcutting clutch' – Martin Cleave's simplified diagram showing how the screwcutting clutch works.

foolproof thread cutting, it is difficult to see why this was not adopted as the standard method of design for all screwcutting lathes thereafter.

Alastair Sinclair

Given the high levels of interest in screwcutting clutches for modern lathes based on the Hardinge design in recent years, we felt that Martin Cleeve's article would be particularly useful for readers, visit www.model-engineer.co.uk and click on 'features' then 'article reprints' – Neil

Small Motors

Hi Neil, In MEW 225 Neil MacNaughten has requested help in sourcing a motor to drive his Arrand milling spindle. I use a 120W sewing machine motor from Alan's Alterations, 20 Maeshenllan, Llandre, Ceredigion, Dyfed, Wales SY24 5DD, tel. (01970) 820-200 (I purchased mine via eBay). This drives my Arrand spindle, using the belt supplied with the motor on the larger pulley, at about 2,000 rpm when milling steel with a 1/4 inch slot drill. The attached picture shows the system attached to a Myford vertical slide. I hope this information is useful.

Rod Jenkins, Tadley



Arrand Motor – Rod Jenkins' sewing machine motor fitted to his Arrand spindle.

Vertical Lathe

Dear Neil, I read with interest Jock Miller's article about his vertical lathe. Is there any possibility of asking him for more photos and hopefully some sort of sketch of the works? I know he said he sketched it out on the back of an envelope or two. I have Googled vertical lathes but they don't really help as they are mostly massive industrial machines.

I am considering the possibility of making something similar because I don't really like "watch making" as you saw at the exhibition.

Keep up the good work with MEW and thanks for many interesting articles.

Ian Strickland



Mystery Device

Dear Neil, Just a quick e-mail about the oddity in photo 22 of your report on tools at the ME Exhibition.

The gadget is a rev counter – i.e. it only counts revs – you also need a watch to determine the speed of a shaft as r.p.m.

It looks like one of the Starrett versions, I have attached a copy of a page from their 1928 catalogue which shows Model 107, the Registering Speed Indicator priced at 15 shillings (75p!) which looks very similar. The catalogue also lists a surface speed attachment (a rubber tyred wheel to fit the shaft) which would be useful.

I have a couple of these neat little gadgets, one by Starrett and another by Lufkin – unlike modern devices you don't need a power supply.

Malcolm Leafe



The page from Starrett's 1928 catalogue.

Arrand Assistance

Dear Neil, Reference Neil Macnaughton's plea for a drive for his Arrand Milling Spindle, the easiest way is to use a 'Flexi drive' with an electric drill supplying the power. The disadvantages? The handle of the Flexi-drive needs to be attacked with a rasp to file flats on it so it can be clamped down and there is a lot of end float on the chuck and wobble. On the positive side, you can get up and going in a hour or so. A nicer way would be to use a pulley mounted in place of the moving steady with a drive across the bed to another pulley on the end of the Arrand. If the pulley shaft is extended 6 inch towards the tailstock, then a splined drive could be put on it to receive drive either from an electric drill down the tailstock end or for a more exotic solution, from a drive off the end of the leadscrew.

For a crude splined drive use a short piece of square mild steel tubing on the end of the drive shaft, with a square section on the output shaft so it can slide in and out (all slathered in grease). A pin must be put through the tubing to stop the square section coming right out or it will beat the lathe bed to death.

Frank Brown



Turn of the Screw

Dear Neil, I'm interested in the Ainjest attachment described in the last issue of MEW, is it possible to get some drawings? I've understood that the clutching of the lead screw is made only when allowed by a thread dial indicator, and I think that many readers would be interested in knowing how this is done.

Jacques Maurel

We would love to hear your comments, questions and feedback about MEW
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One Man and his Lathe

John Harris and his Atlas 10-FV/36



John Harris tells the story of his elderly, but still eminently usable, Atlas 10-FV/36.

So, why did I choose an Atlas Lathe? Mostly the reason is because of my background. I'm not a trained engineer but my Father was, and he not only worked as an engineer, he had workshop full of machinery and tools at home. So I was brought up in an environment where there was always access to tools and machinery which, importantly, included a lathe. In the 1950s, 60s and early 70s if something broke then it was repaired, and we had the equipment to do it so we did! We also made parts for my motorcycles when I modified them and especially when I started racing them.

The lathe I learnt on was a 3½ inch Union which had been scrapped by my Father's employers and he had rebuilt, including making a new headstock. So one of the first things I bought when I acquired a house with workshop space was a lathe.

The Atlas I have is my second lathe. I originally had a South Bend lathe and was thinking of changing it to a new far eastern lathe when I came across information about Atlas lathes which changed my mind. The Atlas had many similar features to the new lathe I was considering, was considerably cheaper and had the advantage of being an interesting 'project'. As I didn't have to sell one lathe to help fund the next I was able to use my existing lathe in the renovation.



John's Atlas 10-FV/36.

Atlas lathe history

America is the home of mass production and the Atlas lathe was designed to use those techniques. These lathes were built by the thousand by the Atlas Press Company, now named Clausing Industrial, from the late 1930s to the late 1950s. During World War II large quantities of these lathes and their associated spare parts came to the UK under the 'lease lend' scheme, which is where my lathe probably came from. After the war the UK company, Acorn Tools, who handled the import of Atlas lathes during the war, used the spare parts to make new lathes. These lathes were marketed as Atlas lathes and under the names, Acorn Tools, Halifax and Sphere. Although there were some minor changes in reality they were all Atlas lathes. In the USA Atlas lathes were also sold under the Craftsman name through the Sears Roebuck organization.

Some new spares are still available from the manufacturers, who are still in business, and there are often used parts available on eBay. Most weeks on eBay a lathe will be offered for sale.

Until he retired Mike Kurn was managing the UK company which made Acorn Tools, Halifax and Sphere lathes and spares. On



The lathes change gears and countershaft drive.

his retirement he took over selling the remaining spares. He has used and new spares for sale (**ref. 1**).

Atlas lathes have strongly supported groups on the internet. The Yahoo group can be found at https://groups.yahoo.com/neo/groups/atlas_craftsman/info and the Machinist Web group can be found at <http://www.machinistweb.com/forum/index.php>

Atlas Lathes

Atlas lathes are a classic back-geared screw-cutting 'bench lathe'; a self-contained unit with the ability to handle a wide variety of work and it, as the name implies, can fit on a workbench (**photo 1**). It weighs about 250lbs and can be manhandled by two fit people after the motor and tailstock have been removed. To lighten the lathe more, removal of the carriage and leadscrew is straightforward. There are many versions of the basic design, such as headstock bearing type (plain and taper roller), swing (10 and 12 inches), bed lengths (between 36 and 54 inches) and position of the countershaft (vertical or horizontal).

My version is known as a 10-FV/36, probably the most common model in the UK. This translates to a lathe with a 10 inch swing (5 inch centre height), power carriage feed, power cross-feed (Facing), Vertical countershaft and a bed length of 36 inches (**photo 2**).

The mandrel is threaded 1½ inch by 8 tpi, and bored 25/32 inch. The mandrel thread is the same as the South Bend lathe and its clones such as the Boxford which gives a wider selection when looking for faceplates, chucks and the like.

A selection of change gears for screw-cutting were originally supplied with the lathe. These gears and several other parts of the lathe are made of *Zamak*, an alloy of aluminum, manganese and zinc, which is not what is often referred to as 'pot metal'.

Atlas lathes do have two unique features, a reversing gearbox on the lead screw (**photo 3**) instead of the more usual tumbler gear set up, which is used on later



The reversing gearbox.



Bull wheel with indexing holes.



T-slotted cross-slide.



Rear toolpost.

One of the benefits of the Atlas is the power feed to the cross-slide. This is driven from the leadscrew which is controlled by the reversing gearbox. This gearbox gives neutral, forward and reverse rotation of the leadscrew.

models, and a basic 'dividing head' on the bull wheel. The power feeds to the carriage and the cross-slide is provided by a slot in the leadscrew.

The bull wheel has 60 holes in one face and a locating pin mounted in the headstock; a basic dividing head (**photo 4**). Using this facility, and a tool-post drill, I have made circular covers with equidistant mounting holes drilled. This becomes an easy operation to set up, with only the required circle to be marked.

Atlas also made a wide range of lathe extras and a very comprehensive lathe manual. Apart from the usual steady rests there were stands, cabinets, collet systems, milling vices, taper turning attachment, tool-post grinders and a 'carriage turret'. This last accessory became the basis for my T-slotted cross-slide.

My Atlas

I bought my lathe through eBay, having viewed it before bidding, with the intention of it being a restoration project. The lathe was completely stripped and repainted, new and used parts were bought as required and a new 'old stock' motor fitted.

The bed was reground by Northampton Engineering Services (**ref. 2**).

I have been for many years an advocate of a 'rear mounted' toolposts, mostly used for a parting off tool. A T-slotted cross-slide is a requirement for this. During the re-build and whilst browsing eBay I noticed a 'carriage turret' for sale and which I bought; this is in effect an Atlas produced T-slotted cross-slide. They were made to have two tool-posts allowing up to five tools to be used without changing the set-up. If I had used this without modifying it I would have lost the use of a compound rest. I bought another compound rest mount, keeping my original 'just in case', and machined most of it away. I milled away one end of the 'carriage turret' to provide a place to mount the modified compound rest. Milling a second T-slot completed the conversion to a T-slotted cross-slide (**photos 5 and 6**).

One of the benefits of the Atlas is the power feed to the cross-slide. This is driven from the leadscrew which is controlled by the reversing gearbox. This gearbox gives neutral, forward and reverse rotation of the leadscrew. Forward means the carriage is

advancing towards the headstock when the half-nuts are engaged. The cross-slide power feed is actuated by engaging the leadscrew in reverse and pulling a rotating knob mounted on the apron; it is not a very satisfactory method of operation with oily hands. To improve this I have made a lever operation, based on an idea I saw on one of the Forums (**photo 7**). This has improved the operation so much that I use the power cross-feed on virtually every job.

I have mounted the lathe on adjustable feet (**photo 8**) to assist in setting up the lathe. By adjusting these feet a bar that protrudes six inches from the chuck can



The author's crossfeed lever.



Adjustable feet fitted to the lathe bed.

have the run out reduced to no more than a 0.0015 inch.

I am always considering ways to modify the lathe to suit my needs. One of these is an improvement to the dials. At the moment they are too small and indistinct so I intend to make larger ones which will be easier on my aging eyes! But I also intend to fit thrust bearings on the cross-slide screw, which means making a new mount and a cross-slide screw to suit the new bearings. To make the dial I need to make an indexing device as I don't have a dividing head. I also intend to make some changes to the tailstock locking arrangement and machine a new leadscrew that comes from another make of lathe but will fit. Plenty of things to do!

Uses

My workshop activity is not 'model engineering' but what might be called 'general engineering'. As I mentioned previously, I owned and raced motorcycles and I still own a motorcycle. The motorcycle which I built is a replica of a prototype, which means there are a considerable number of parts that had to be made. Although the motorcycle was built before I had the Atlas lathe I am still



Some of the author's shop made accessories include this front and rear tool height gauge...

instance, making a new drive shaft for a vintage lawnmower has been a recent request. The lathe performs amazingly well when asked to do jobs which are really too big for it.

Advantages

The Atlas lathe can be a cheap way into engineering. In the period between the 7 August and 17 October 2014 eleven Atlas lathes were sold on eBay for an average price of £210. The sale price ranged between £50 and £385. That last price was for a well equipped lathe which gave the impression that it could be taken home and used straight away.



...a well-proportioned fixed steady...



...and this carriage stop.

large quantities between 1941 and 1945 under the 'lease lend' scheme. With age comes wear and tear so viewing before bidding is a must.

There can also be problems with the gears made of Zamak. These gears are found as change gears, in the headstock, in the reverse gearbox and the apron. The Zamak can delaminate and clumsy handling can knock teeth off in the reversing gearbox and the apron.

You should also bear in mind that the Atlas was built as a general purpose lathe and is not as rigid as a tool-room lathe even though its capacity is similar.

Conclusion

Writing this article has made me take stock of my lathe and ask myself 'would I buy another Atlas?' If I was in the same situation again, I would. It has also prompted me to make the effort to finish some of the plans I have for the lathe! With the knowledge I have now, if I do change my lathe, it will only be for one which has greater capacity. Generally I can honestly say that this lathe has given me a lot of pleasure, and the satisfaction of putting it in a condition that should have it last for many more years. ■

REFERENCES

1. Mike Kurn 01344 883417
michaelkurn@hotmail.co.uk
2. Northampton Engineering Services
01604 766275

Writing this article has made me take stock of my lathe and ask myself 'would I buy another Atlas?' If I was in the same situation again, I would.

making and modifying parts for it. Last winter I made new footrests, brake lever and kick-start lever. The kick-start lever started out as a piece of Citroen drive shaft. Using the tailstock offset and the power feed I taper turned this tough piece of steel with no problem. As anyone who has built a 'special' will tell you, they are never totally finished!

Apart from my motorcycle my son rides motorcycles and likes to modify cars, which brings more requests of 'can you just make/alter this?' Another motorcycle use is the making and repairing of parts for a friend whose daughter races motorcycles. These parts demand a fair degree of accuracy as the parts are often safety or performance critical.

I do like to make tools for use in the workshop, normally a tool to assist in a job I have been asked to do (photos 9, 10 and 11). Having a lathe, and a well equipped workshop, means I have a steady stream of friends and neighbors asking 'John, can you just...?' For

It is worth noting that a lot of these lathes, especially those post WWII, were sold to the model engineering fraternity or to companies who haven't used them for years and these can be in very good condition with little wear.

The Atlas lathe can perform a wide variety of tasks and, with careful set up, be accurate. There are many used parts available and plenty of information available from the Forums. The Forums also have available, free, copies of the Atlas Lathe Manual, Parts List and exploded drawings. The Forum members have always been helpful when advice has been required. Being a member of the Forums could be likened to joining a club. They were and are a great help with my restoration and supplying ideas for improvements.

Disadvantages

The main disadvantage of Atlas lathes is they are old. A lot of the lathes in the UK are over 70 years old as they arrived in

New Products from Dremel

Dremel 8200-20

Readers may remember how impressed I was with the Dremel Micro. The 8200 is its big brother, and has had its specification updated, so I was keen to see what this meant in practice. The Dremel 8200 is a cordless multitool, and the changes give it with enhanced runtime yet with faster charging. This allows the user to perform much heavier duty applications than with the micro – at the cost of the 8200 being a much larger, heavier tool.

The new 8200 is supplied with a pair of 2.0Ah 10.8V Li-ion batteries with a 30 minute charger and has a 3 LED battery gauge to show accurate battery status. This is a setup that should enable you to keep the machine in virtually constant use. Full variable speed control up to 30,000 RPM is welcome, and makes this ideal for tasks with cutting discs in inaccessible spaces – such as under the car!

As is usual with Dremel, it is small details that stand out, one of these is a motor brake to stop the tool spinning immediately after switching off. As

someone who is very good at pressing collet lock buttons instead of the on/off switch, I was also impressed by the simple addition of a collet lock-out function. It's also easy to change and fit accessories without having to use a wrench.

Between the micro for precision tasks and the heavier duty 8200, these two tools cover almost every base. If you make a lot of use of hand-held rotary tools, it is worth considering going cordless.

The Dremel 8200-20 kit contains a Dremel 8200 cordless multitool, two 10.8V Li-ion 2.0Ah batteries, a 30 minute charger, 20 Dremel cutting, grinding, sanding, polishing, accessories including Dremel EZ SpeedClic, all packed into a Dremel soft bag. The set retails at £145.



Dremel DSM20 Compact Saw Accessory Cutting Set

I should start by introducing the Dremel DSM 20 – described as a compact saw, it resembles a cross between a circular saw and a lightweight angle grinder, but it uses smaller diameter proprietary blades and, unlike an angle grinder, it has a worm drive instead of bevel gears and runs eerily smoothly. The one criticism I have of this device is that it has rather less depth of cut than an angle grinder. To be fair this is made up for by the much higher degree of control you have over the cut, not least as there seems to be less of the 'gyroscope' effect which anyone who has used an angle grinder will be familiar with. You also have a depth control, which is very useful – when you remember to use it!

Dremel is offering a £30 saving on its new DSM20 Compact Saw cutting set which comprises seven high quality accessories for the DSM20: a SM500 Multipurpose Carbide Cutting Disc, two SM510 metal & plastic cutting wheels, two SM520 Masonry Cutting Wheels, a SM540 Diamond Abrasive Wheel and a SM600 Multipurpose Carbide Flush Cut Blade. The blades are supplied in a rather nice box with a window front.

The idea of the set is to give you the ability to cut through a huge range of

materials. I tried out the brick cutting disk to chase grooves for burying satellite leads in a wall. Originally I had the depth of cut at maximum, and the blade cut through the brick as well as the plaster at a remarkable rate. After the first cut, I realised I needed to connect the dust extractor to my workshop vacuum. I did need to use some duck-tape to hold the pipe in place, but this hugely reduced the amount of dust generated.

Individually purchased, the wheels in the set would cost £75 but are being offered in kit form for £45.



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Rich Wightman and Julian Harrison combine their talents.



The motor and drive system.

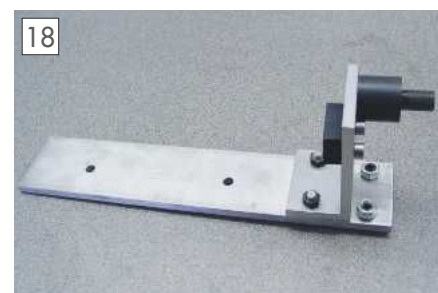
I wanted to power drive the lead screw on my Myford lathe without going to the trouble or expense of fitting a stepper motor with the associated electronics. I have used 12 volt car windscreen wiper motors and radiator fan motors on other projects so I knew a wiper motor would be powerful enough and do the job nicely. It just needed to be controlled in some way, forward and reverse plus variable speed if possible. The mechanics I could do myself but the electronic side of things were a bit of a mystery. My mate Julian looked into it and said he could build a controller that would give me the required functions. Between us we worked it out and built a very useful accessory.

The following article is how I achieved it with the help of Julian. As with most of my projects there are no plans as such, as it was a trial and error type of project made up as I went along. It will be mostly photos, but I will include a few sketches.

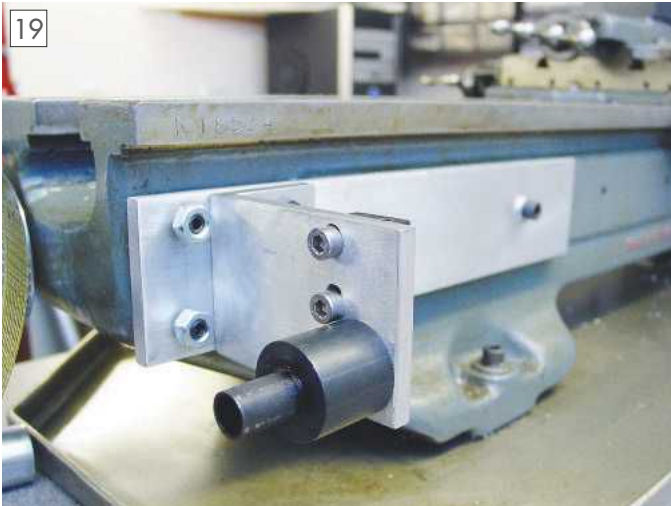
A Powered Lead Screw for a Myford Lathe Part 2

Mounting the motor to the lathe is a straightforward job that I over-complicated. I wanted to make the belt quick release, so decided that the motor should tip up pivoting on a single spindle. The motor has three 6mm tapped holes for mounting of which I used one. I made a $\frac{3}{8}$ steel spindle turned down and threaded 6mm on both ends. This with the aid of a drop of thread lock is screwed tightly into one of the motor mounting holes. The spindle in turn fits into a steel bush on the mounting plate and secured with a washer and self-locking nut. This in fact is all that's required, hind sight is a wonderful thing. I spent some time making a strong spring loaded ball catch that locks into dimples on the spindle, it can be seen in photo 18, but isn't necessary just fit a lock nut and tighten until the motor can be pivoted but has some friction. Very conveniently the Myford has a couple of useful tapped

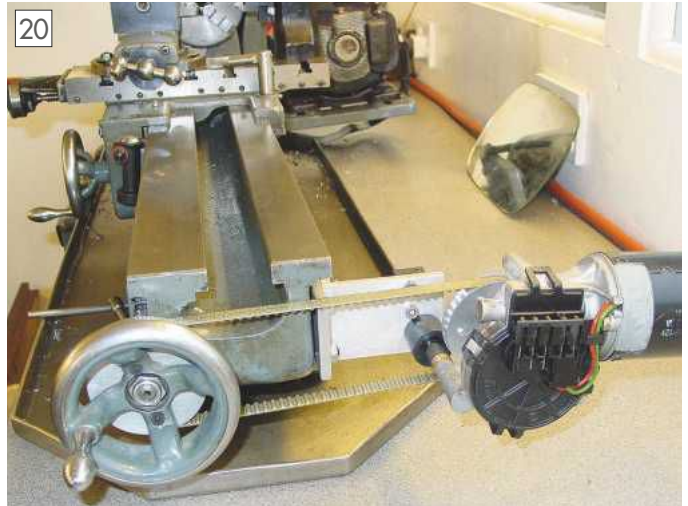
holes along the back although I did have to source a couple of BSF bolts. A piece of aluminium bar has two holes drilled to suit onto which is bolted a piece of aluminium angle and then a steel boss drilled and reamed to suit the spindle (**photo 18**). The cam action of lifting the motor releases the belt tension and pushing the motor downwards tensions the belt.



Motor mounting bracket.



The bracket fixed to the lathe bed.



The completed mechanical parts in place.

The other two screws and nuts you can see are long grub screws and lock nuts. The grub screws are adjusted until they touch the lathe and then have the locknuts tightened. In use I found the aluminium bar was flexing so this gives it a little more rigidity. **Photograph 19** shows the mounting bracket fitted to the lathe and **photo 20** shows the motor and belt fitted.

It's now time to pass you over to Julian to explain the controller in detail.

Speed control

Firstly I will give a quick mention of the control system. There are several ways to control the speed of a dc motor. Most involve reducing the voltage in one way or another. If a 12v motor is supplied with its design voltage of 12v it should run at its optimum speed and power. If a resistor or a rheostat is used to reduce the voltage the speed will decrease accordingly. 'Job done' you may say but you would be wrong. The problem here is that the power or torque of the motor will drop at a far greater rate than the speed. The result is a motor turning at the speed we want but without any power to drive any load. It is usually a requirement that the motor turns slower but still has to drive a full load. One way to overcome this is to fit a motor that is so powerful that at reduced speed and reduced torque it still drives the load required. This would normally be either far too expensive or impractical or in some cases near impossible. The better way is with a Pulse Width Modulated (PWM) controller. This is a small circuit that pushes the power out in bursts. We are talking thousands of bursts a second. Every burst gives full voltage and more

importantly full power. The speed is controlled by the frequency of the bursts. The higher the frequency i.e. more bursts per second, the faster the motor turns and therefore the lower the frequency, less bursts, the slower the motor turns. Because each burst is at full voltage and full power the motor still has its full torque even at very slow speeds. Rather than building a speed controller I opted for a ready-built unit. The one I chose was the 12v speed ready-built controller module from Maplin Electronics. I chose Maplin's unit only because there is a branch near me. Other equivalent makes and models are available and really it just becomes a choice of accessibility for me. I also bought the project box and switches at the same time.

Direction control

Switch one controls the direction that the motor turns. This switch is the type known as 'dpdt'. This is double pole double throw. Essentially this is two switches built together as one. Both switches have their own connections but switch together at the same time. They have three positions which are to connect the centre connection to only one of the other connections

(poles) or fully off when centred. Thus allows the connections to be wired to allow the change of direction.

The controller puts out the correct output for the speed of the motor. This output is directed through the switches to select direction and movement. Switch number one selects the direction of rotation of the motor and hence the direction the carriage moves in. I suggest this switch is wired so the throw of the switch matches the direction the carriage move in. Switch two selects either constant movement or button controlled movement. When switched to constant movement the carriage will move at the speed selected until the switch is turned back off. If switched towards button control the carriage will only move when the button is pressed and held down. Releasing the button stops movement. Power for the motor and controller is provided by any suitable power supply with enough capacity to run both.

Building

Figure 2 shows the circuit and **fig. 3** is a simplified wiring diagram. I usually to make the wiring easier to solder drill the lid of the box to take the switches and fit

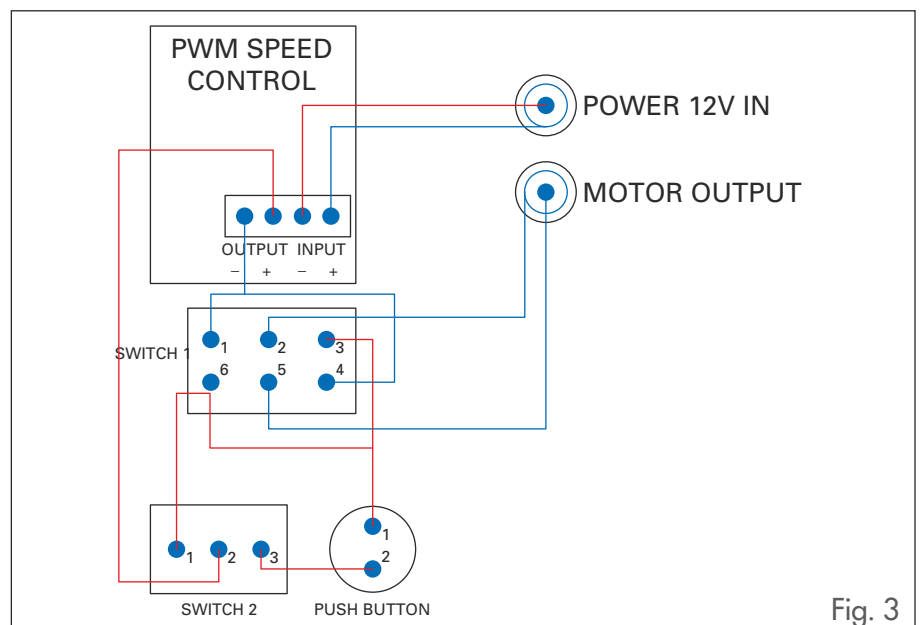
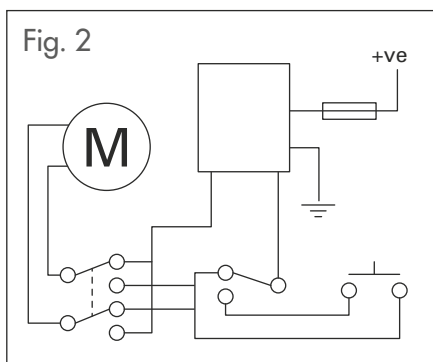
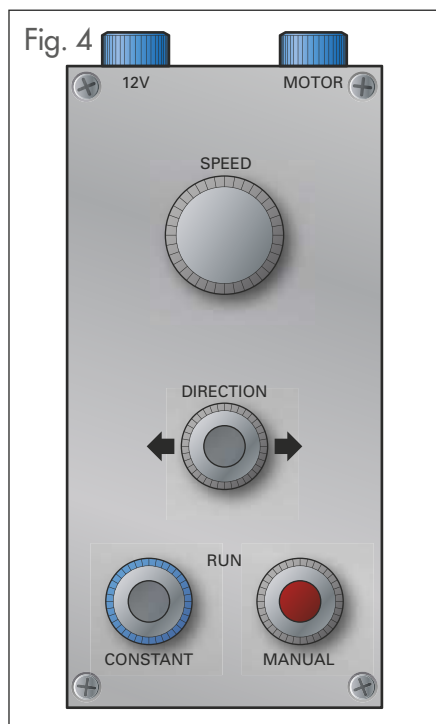


Fig. 3



them all. Location is a personal choice to suit the user and the box selected. **Figure 4** shows a reasonable suggestion for layout. Label each to identify them and their actions when switched.

I find it best to attach the wires in their logical electrical path or order. The direction switch is the double pole double throw type so will have six connections on the rear in two rows of three. With the switch mounted so the throw is side to side the rear connections will be orientated in the same way i.e. the rows of three will run in the same direction. If you have followed my layout the logical use of the switches is from top to bottom.

Normally you would work downwards by selecting the speed then selecting the direction then either switching for continuous movement or pressing the button. Be aware that while this works for logical use of the control box the order does not work for the logical wiring order inside the box.

Connect a wire from the positive output of the speed control module to the centre pin of the run switch labelled pin 2 in fig. two. Solder a wire from the pin nearest to the push button to one of the pins on the push button. It does not matter which connection you use on the push switch. Wire the other connection on the push button to the switched connection of the continuous run switch leaving a suitable length to then connect to the direction switch. Using diagram two for reference connect this lead to connections 1 and 4 on this switch. Run a lead from the negative output connection on the control module to connections 3 and 6 on the direction switch. Drill the box and fit the sockets. Wire the two remaining connectors on the direction switch (2 and 5) to the motor output socket using lengths of cable that allow the lid and its box to be laid easily side by side. At this stage it does not matter which way these are connected as they can be changed later if needed. Wire the power socket outer connection to the control module

power input labelled input negative. Wire the centre connection of the socket via the inline fuse to the input positive connection on the module. Using the centre of the plug for the 12v positive stops a short if the plug catches a metal surface. The reason for wiring in this order is because power comes in through the socket and through the fuse to the control module. The control module sends out the controlled power to the movement switches. The continuous run switch and the push button are wired together so either can be used. Whichever is chosen the controlled power is fed to the direction switch. Because we have crossed the connections on this switch the direction of the switch will select which connection is positive and which is negative for the motor and therefore the direction the motor turns.

Solder a plug onto the power lead so the positive is the centre connection. It is important that this is correct as the speed control module must have its positive supply at the correct connection. Solder a plug on the end of the motor lead. It does not matter which way round these connections are as the direction will be set during testing.

Testing

Check all screw connections are tight and all soldered connections have in fact been soldered and are secure. Check that none of the connections on the switches are touching any adjacent connections on the same switch. Switch both switches to their centre positions and twist the speed control to its lowest speed. Plug in the power supply but not the motor and switch on the power. Check with a multi-meter that you have power to the speed controller module input and that the polarity is correct. If it is correct and there are no obvious problems switch off, plug in the motor and restore the power. Turn the speed control up to half way and switch the direction switch to either side. Move the run switch towards the push button. Pressing the button should now

turn the motor. Release the button, switch to the opposite direction and press again. If the motor turns on both occasions repeat the test with the constant run instead of the button. If the motor does not turn check all the connections as you will probably find one or more wrong. Next test the speed control by changing the speed while on constant run. Obviously movement of the speed control in either direction should alter the motor speed. If all is correct and working the control box is complete. The one remaining test can only be done when you know the direction of rotation needed. If, for example, this unit is to control the movement of the carriage of a lathe or an axis of a mill then it is worth fitting the motor and gears first. Connect this controller to the motor and select a slow speed and a direction to travel. Switch to button control and press the button. Check the direction the carriage moved and release. If the direction matches the switch direction on the box then no further changes are needed. If the direction is wrong disconnect the power to the box. Swap the motor connections either at the motor or inside the box at either connections 2 and 5 on switch one or at the motor output socket. Reconnect power and retest. All should now be correct and the carriage should be moving in the correct direction. Close the box and screw the lid down. Your controller is now ready for use.

With the power feed now tested and proven to be more than satisfactory I made up a belt guard from Perspex (**photo 21**). There is very little risk when using the power drive as it turns very slowly and if too much load is put on the motor it tips upwards automatically releasing the belt.

A video of the system can be seen here <http://youtu.be/BoFSz2LGgkM>

And this is a video of the power feed doing some work.

<http://youtu.be/3MnsBobAJ1w>

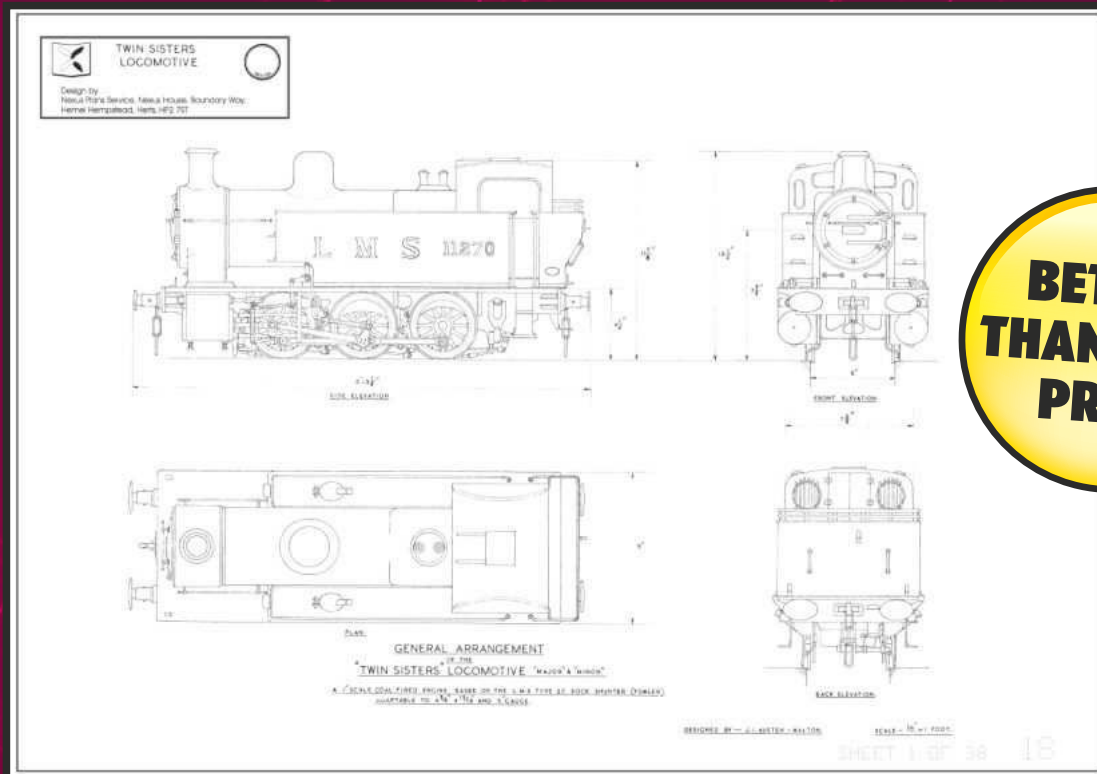
This mod works so well that very rarely do I turn anything by hand. The finish I can achieve is far superior to work turned by hand. ■



The final set-up with belt guard fitted.

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Threaded Inserts and other **Hot** Topics ^{Part 2}



Mark Noel grows tired of tapping.

Although different models vary in rated power, all modern ATX supplies conform to an agreed standard with regards to colour coding of the wires and the voltages that they carry. This is to ensure that components such as the motherboard, DVD drive and graphics cards will interface correctly with voltages that match their individual specifications. The typical ATX unit has a bunch of cables that are duplicated and branch to several connectors, and **photo 9** shows one of these with the wires labelled accordingly (identical wires run to other connectors).

Amongst the forest of wires, those of particular interest to us are the +12V (yellow), Ground (black), +5V Standby (purple) and Power ON (green). When you press the start button on the front of your computer a micropower watchdog circuit on the motherboard acts to connect the green Power ON to Ground, activating the +12V (and 3.3V, etc) circuits and starting up the PC. The only exception is the +5V Standby voltage which is always ON, since it is needed to constantly power the watchdog unit. Hence, a fortunate aspect of the ATX design is that it enables the control of a large current supply by simply triggering the Power ON line. Furthermore, this trigger circuit can be supplied from the permanent 5V Standby line which easily delivers sufficient current.

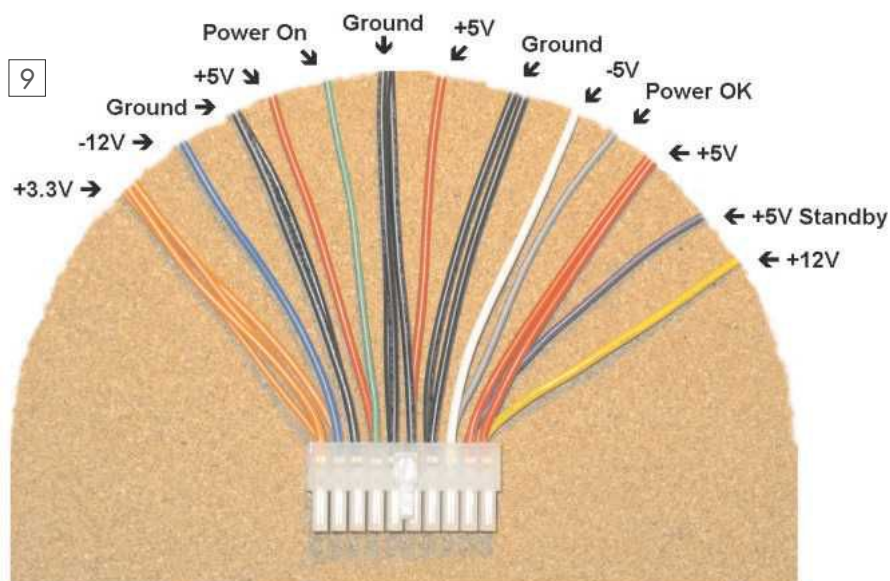
This article describes the use of threaded metal inserts as a speedy and economic alternative to the tiresome manual creation of tapped holes. These versatile components are particularly suited to the joining of plastic and soft alloy components, and are available in a range of sizes and specifications to suit most applications. The development of a heated insertion tool led unexpectedly to some other gadgets, one of which has proved to be a welcome addition to my chilly workshop this winter.

In my design the array of heater resistors is connected between the +12V and ground wires, with the power being varied from about 10% to 95% by a Pulse Width Modulation (PWM) circuit that cycles the ATX on and off at about 3Hz (**fig 2**). Higher frequencies would be possible but the advantage of this low rate is that the ATX

fan can be heard pulsing, providing an audible confirmation of the PWM cycle.

The next challenge was to decide on a method for measuring the temperature of the heat stake, using a sensor that could operate from about 20°C to 130°C, or slightly higher to provide an allowance for thermal gradients from the sensor to the

Eventually I discovered that the thermal characteristics of a silicon diode could provide the basis for a simple and inexpensive sensor that spanned the temperature range required.



The wires leading to one of the ATX power connectors. These comply with a standard scheme of colour coding for each of the voltages shown. Some or all of these wires go to other connectors.

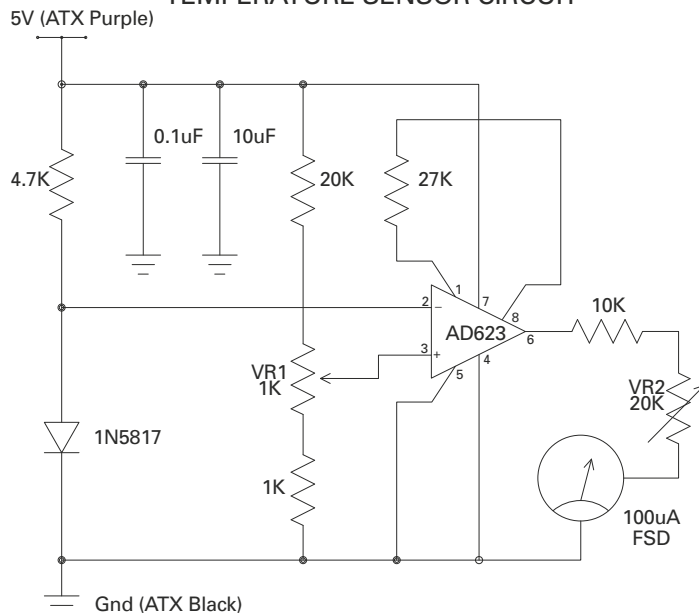
tip of the heat stake. This temperature range is somewhat problematic, since it occupies the region between low-cost easy to use thermistors (to about 80°C) and more expensive, harder to interface thermocouples (to 1000°C or more). Platinum resistance sensors of the type used to monitor solar panels are a good option but are expensive both to buy and to build the circuits that display the temperature. Similar limitations apply to the newer technologies of infrared thermometers, while cheap liquid crystal film sensors are not available with high temperature ratings.

Eventually I discovered that the thermal characteristics of a silicon diode could provide the basis for a simple and inexpensive sensor that spanned the temperature range required. When passing a current, these components display a near-linear drop in voltage of 2mV/°C which can be amplified and scaled to give a temperature reading. Common diodes such as the 1N4148 or 1N5817 are less than 3mm in diameter, cost pennies, and can withstand temperatures up to 160°C when packaged

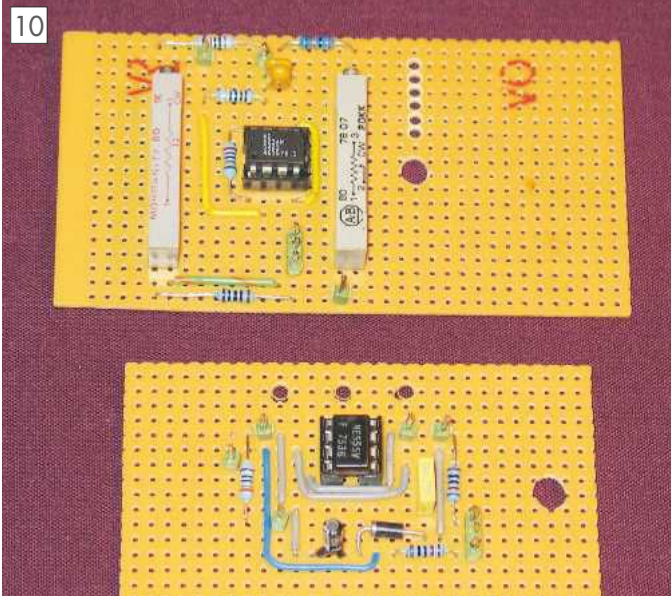
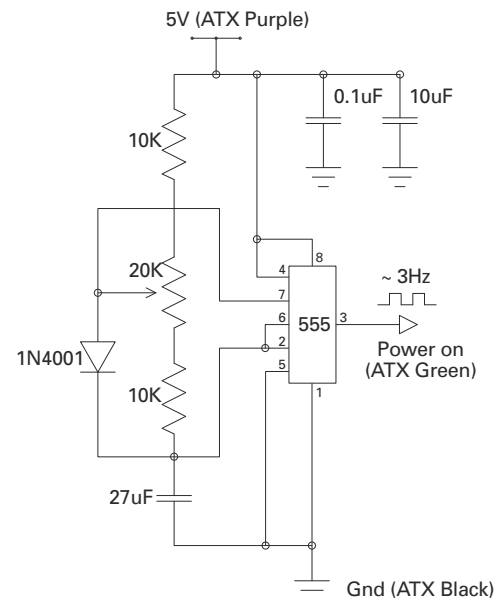
Fig. 2

The circuits used to produce the PWM power control (left) and to measure the temperature (right).

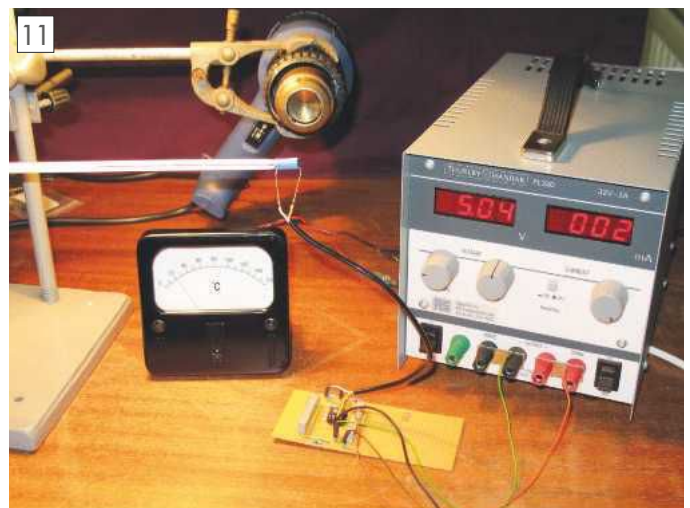
TEMPERATURE SENSOR CIRCUIT



POWER CONTROL CIRCUIT



Veroboards with the assembled circuits for measuring temperature (top) and controlling the ATX power supply (bottom).



Setup for calibrating the temperature circuit. The 5V (nominal) Standby from my ATX actually outputs 5.04V and so the bench power supply has been set to this value to ensure an accurate calibration. VR1 and VR2 are adjusted after repeated heating cycles from the hot air gun until readings on the meter agree with the mercury thermometer.

in glass or ceramic. My circuit (fig 2) is based on a 1N5817 Schottky diode which happened to be handy, but other silicon diodes should also be suitable, provided you check the temperature rating on the relevant data sheet. My circuit uses an AD623 instrumentation amplifier to multiply the voltage difference between a trimmer potentiometer VR1 and the diode, the output then passing through a 100 microamp moving coil meter in series with a second trimmer, VR2. I removed the panel from the meter and replaced the scale with one marked 0 to 160°C designed and printed from FastCAD. Both the PWM and temperature circuits were assembled on Veroboard (**photo 10**), and then cleaned in

turpentine to remove solder flux which can slowly absorb moisture and create faults. As mentioned earlier, power to both circuits is provided from the ATX +5V Standby supply.

Calibration of the sensor circuit was carried out by attaching the silicon diode to a laboratory mercury thermometer with shrink sleeve, then heating the pair with a hot air gun in steps to increasing temperatures (**photo 11**). VR1 and VR2 were adjusted after each cycle until readings on the moving coil meter matched those on the glass thermometer, after which the circuit was calibrated and ready to use. If at any time the diode happens to fail then it will be a simple matter of swapping it for another 1N5817

whose electrical characteristics should, theoretically, be identical.

I mounted both circuit boards and the meter inside an old Verobox and attached this to the front of the ATX unit by self-adhesive spacers so as not to impede the cooling airflow. As mentioned earlier, only five lines are needed from the power supply to provide 5V, 12V, Ground and the On/Off line that connects to the PWM control board. For good measure I decided to use pairs of wires for the 12V (yellow) and Ground (black) to ensure adequate current carrying capacity and these were taken with the other two (purple and green) to a terminal block inside the Verobox from where connections were made to the two circuit boards (**photo**



Interior of the Verobox showing the PWM circuit at top and temperature sensing circuit below. Heater current from the ATX unit is connected to a Europlug type of socket on the side of the case where a pair of 4mm sockets for the temperature sensor are also located.

12). I also added wiring from the 5V supply to a green LED on the front panel to show when 'all subsystems are in power-on status', although I stopped short of adding a label with this text! The PWM control potentiometer was fitted to the front with a Bakelite bezel salvaged from a vintage radio. A standard Europlug socket was mounted on the side of the Verobox to supply current to the heat stake, while a pair of colour-coded, 4mm sockets were also added to connect to the temperature sensor. Alternatively, a single 4-way connector with adequate current rating could be used in place of this combination which simply made use of components scrounged from my electrical parts bin. Finally, all the unwanted wires from the ATX supply were pulled back inside the unit, cut short and their ends made safe with layers of shrink sleeve. The final assembly is shown in **photo 13**.

The heart of the heat stake is an array of four 6.8 Ohm, aluminium-clad power resistors, each rated at 25W and connected in parallel to give an effective resistance of 1.7 Ohms. When the PWM-controlled supply from the ATX unit is at its maximum of 95% (a peak of 11.4V), the power dissipation in the array will be $11.42/1.7 = 76.4$ Watts, which I guessed would be sufficient to raise the temperature to at least 130°C. It certainly burnt my fingers during a bench test! In fact the calculated peak power will be an over-estimate due to dissipation in the wires carrying current to the array, and for this reason I used a hefty 4-core cable to minimise such losses.

Figure 3 shows the completed heat stake as a solid model created in Alibre Design (**ref 5**), both as an opaque assembly and one in which some of the parts are rendered transparent to show internal detail. I found the process of

Solid models of the heat stake created using Alibre Design. The version on the right is rendered with several parts transparent, and with two resistors removed, so that the sensor diode and various drillings are visible.



The completed, controllable ATX power supply with moving coil meter temperature display.

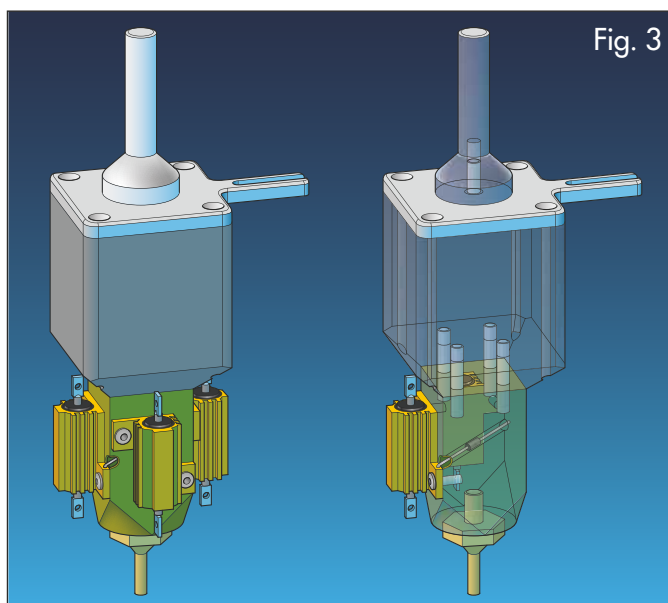


Fig. 3

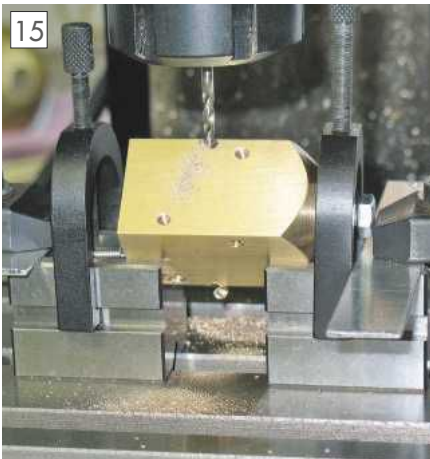
working with a solid modelling program very beneficial, since it provides assurance that all parts will fit correctly, it can reveal internal drillings, and it provides a realistic image that ensures that a design simply 'looks right'. The downside is the steep learning curve involved with such complex software, although in my experience I found it possible to create useful solid models of several projects within a day or two of starting out.

The heat stake comprises four main components (**fig 3** & **photo 14**). At its heart is a solid brass block of $1\frac{1}{8}$ in. square section stock, 50mm long, onto which are fixed the four power resistors. A 3mm diameter hole is bored diametrically through this block to provide a cavity to house the silicon diode sensor (**photo 15**). The lower end of the block is tapered 45 degrees and threaded M6 into which a choice of staking tips can be fitted depending upon the application.

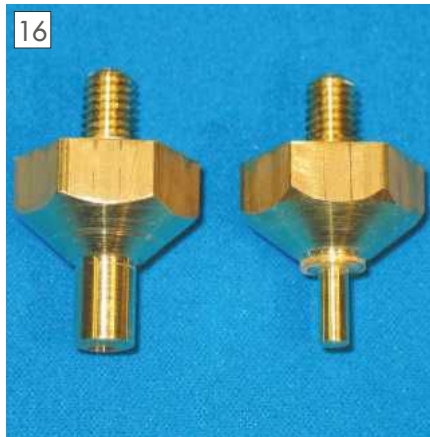
Photograph 16 shows two tips which I have made: one to fit the Anchor M4 insert mentioned previously, and another for heat-staking plastic pillars into a domed profile. The heated brass block is insulated from the upper part of the assembly by a block of Thermalite foam cement, which Linton Wedlock described in *MEW 198* as an effective insulator inside his casting



Main components of the heat stake. Not shown is a thin fibre insulating fibre washer that fits between the aluminium spigot and square top plate to reduce heat loss to the pillar drill.



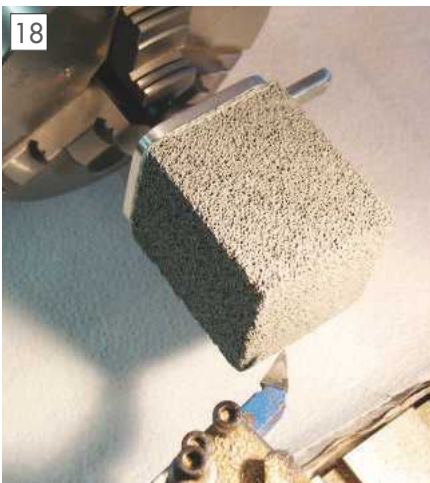
15 Boring the 3mm diameter hole through the brass block that will house the diode sensor.



16 Two heat stake tools: one for emplacing the M4 threaded insert (left), and one for doming plastic pillars and other applications (right).



17 CNC machining the top plate for the heat stake.



18 Skimming the Thermalite block to length.



19 Drilling the four holes through the top plate and Thermalite block for wires that will connect to the heaters and diode sensor.



20 Finishing the Thermalite insulation block by sanding over a driveway pavior immersed in water.

furnace. This block is designed to be 50mm square in section and 60mm long, but was initially cut a few millimetres oversize using a wood saw under a steady flow of water from a garden hose. After thorough drying, the block was glued to the aluminium top plate, which had been CNC profiled from 5mm thick plate (**photo 17**) and roughened on the underside with a coarse file. The adhesive I used was Geocell Quickgrip, a gap-filling multipurpose adhesive available from builders' merchants which can tolerate temperatures up to 80°C. Tests on a Thermalite sample demonstrated that the bond to aluminium was much stronger than the foam cement itself.

Once the Quickgrip had cured, the top spigot was screwed onto the assembly, enabling the Thermalite to be turned back to the design length of 60mm, taking care to protect the lathe bed from cement dust (**photo 18**). Next, four 3mm holes for the power and sensor wires were drilled through the Thermalite using those in the top plate as a guide (**photo 19**). The Thermalite insulator block was then finished to 50mm size and square by rubbing on a smooth brick pavior immersed in a bowl of water, which I found gives a nice finish to this rather friable material (**photo 20**). The same process was also used to produce the 45° chamfer at the end, judging this angle by eye. **Photograph 21** shows the finished Thermalite and brass blocks, with M4 stud



inserts and matching holes, ready for jointing. This was accomplished by mixing a pure cement-water slurry which was pushed into the Thermalite's holes using a matchstick, then pressing it onto the studded brass block to form a tight bond. Before this can be done it is important to thoroughly moisten the Thermalite, otherwise strong capillary suction from the foam cement will instantly dry the

slurry, making it impossible to bring the parts together and weakening any bond that results. Further slurry was applied with an old credit card to give a smooth rendered top coat. After a week of delayed drying under damp tissue, all cement surfaces were buffed with fine sandpaper and then painted with black stove paint to give a pleasing finish.

To be continued...

SUPPLIER REFERENCE

5. Alibre Design (now Geomagic Design) is published by 3D Systems: www.geomagic.com
Mintronics are the UK agent for this software: mintronics.co.uk

Thermalite insulator bonded to the top plate, ready for attaching to the brass block using M4 studs. This was achieved using cement slurry.

On the Wire **NEWS** from the World of Hobby Engineering



Free Expo Catalogues for MEW Readers

The new Expo Drills & Tools 2015 Catalogue has been released. Expo Tools sell a wide range of modelling tools, kits, adhesives, airbrushes, RC accessories and many other products suitable for model makers. The new catalogue has many new and exciting products, and readers of *MEW* can request a free copy. To order your free copy please visit www.expotools.com or send an email with your name and address to info@expotools.com quoting *Model Engineers' Workshop* Reader Offer.

Crowood's Latest Metalworking Guides

The Crowood Press have announced two new titles in their 'metalworking guides' series. *Dividing Tools and Techniques* is a practical guide to dividing and indexing in the workshop by Alexander du Pré, an author who will be familiar to many *MEW* readers. Alex is a naval architect and chartered engineer whose particular interest is in making complex radio controlled vehicles.

As you might expect from a professional engineer the book is thorough and as well as covering the use of dividing heads and rotary tables, he also covers dividing in the lathe in depth. The book also covers dividing with the co-ordinate method and, now that DRO equipped milling equipment is increasingly common, he also looks at electronic dividing methods.

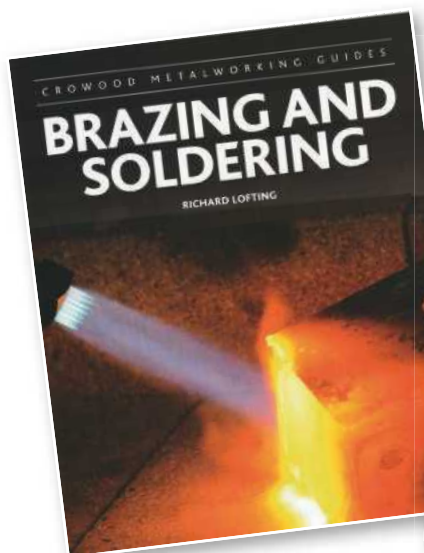


New Lathe from Proxxon

For those seeking a small table-top lathe for precision work, new Proxxon PD 250/E metalworking lathe is the successor to the popular PD 230/E model. The lathe has a distance between centres of 250mm, a swing of 140mm with 46mm over the slide. It has automatic feed and thread cutting facilities and standard accessories include a high-quality 3-jaw chuck (DIN

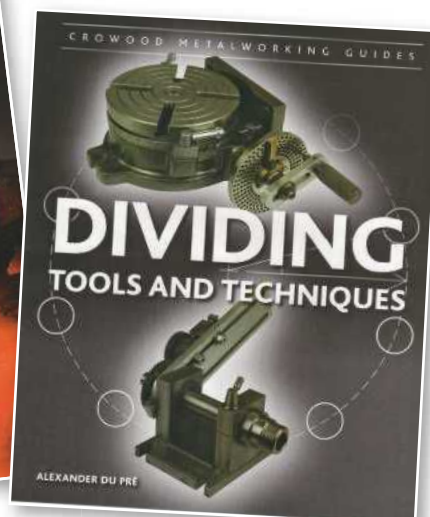
8386 Class 1 concentricity tolerance 0.04mm), live centre and top slide for taper turning. The lathe has electronic speed control with a spindle range of 100-3000rpm.

The PD250/E is now available for £999.96. For more information about this lathe and its accessories, please visit www.brimarc.com



The book has 128 pages and 212 colour photos as well as many diagrams, and costs £14.49. ISBN 9781847978387.

Richard Lofting wrote the earlier Welding guide, restores vintage tractors and is a technical writer on agricultural machinery matters, but here turns his attention to Brazing and Soldering. This 128 page book has 298 colour



photographs and comprehensively covers the field of joining metals with filler materials: soft soldering, silver soldering and brazing. He also addresses areas such as lead loading bodywork and electrical soldering, and offers a number of practical case studies.

Brazing and Soldering is on sale at £14.49. ISBN 9781847978363.

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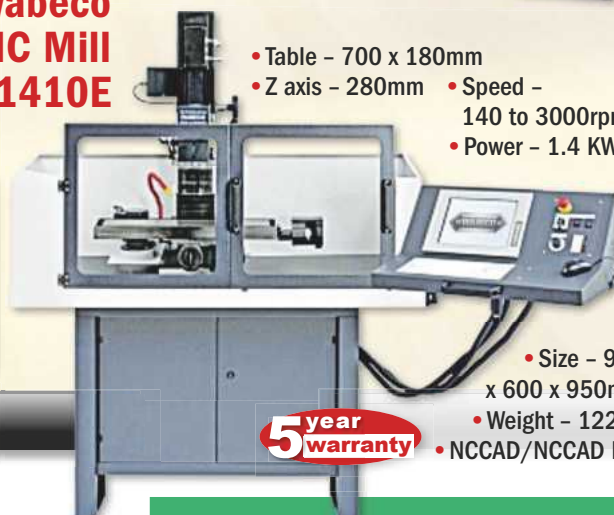
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Two Lathe Carriage Locks



Many lathes provide carriage locks that end in a hexagonal bolt head for a spanner to turn. Mike Haughton makes modified lever locks for his Myford Super 7 and Chester Craftsman six-inch lathes.

At least 30 years ago, when I owned a plain old 1940's Myford ML7 it wasn't long before I replaced the BSF thread carriage lock bolt in the carriage with a lever. This avoided finding the right spanner and took up less space. I have no idea where the lever idea came from, but the implementation worked and I have duplicated it on my current lathes. I find these locks are quick; better than eternally hunting for the right spanner or Allen key, on some more modern lathes. The spanner or Allen key gets lost in the swarf tray or a ring spanner fitted over the bolt head gets in the way or gets knocked off into the swarf tray. Having a quick lever should encourage you to use the carriage lock, making the lathe more rigid in some operations.

Both lathes use a similar carriage clamp that tightens onto the lathe bed below the shears, the Myford at the rear and the Chester (Chizhou CZ300) at the front. The Myford uses a neat eccentric button to clamp the carriage, which can be turned over if it shows a lot of wear. **Photograph 1** shows the Myford Super 7 carriage before modification with the eccentric lock disk removed from



Original Myford Super 7 Carriage Lock.



Original Chester Craftsman Carriage Lock.



Modified Myford Carriage Lock.



Modified Chester Craftsman Carriage Lock.

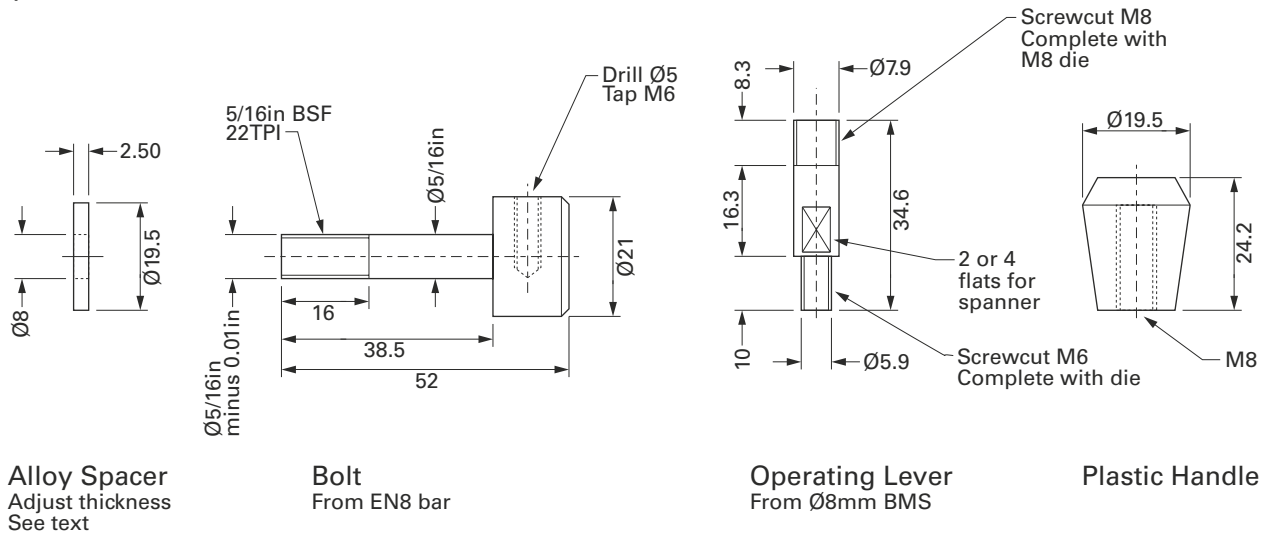
below the carriage. The Chester has a rather crude cast iron stepped plate and a standard M8 metric bolt. **Photograph 2** shows the Chester Craftsman's original hex-head bolt and threaded clamp plate. **Photograph 3** shows the completed modification on the Myford and **photo 4** the final version on the Chester.

Both of my lathes have been fitted with tapered round black knobs, but different sizes as on the Myford, space is rather cramped. I prefer knobs with tapped brass inserts, because the plastic threads seem to wear quite quickly, but these are not always available on the internet auction sites. Alternatively you could turn up a solid brass or stainless steel knob to a shape that you prefer.

Construction Notes

Figures 1 and **2** show the dimensions of my modified carriage locks; apologies for the mixed metric and imperial dimensions in the drawings. Most stock and fasteners I use are now metric, generally cheaper. I turned the bolts from single pieces of 0.4% carbon free cutting EN8 Bright Bar, screw cut the threads to almost full depth and finished the thread form off with a die. The bolts were then parted off at the head end and cross drilled and tapped for the operating handle. Free cutting mild steel would work just as well. The Myford bolt was screw cut without tailstock support, but the Chester, being longer had a small centre drilled hole in the end to allow support from a rotating centre.

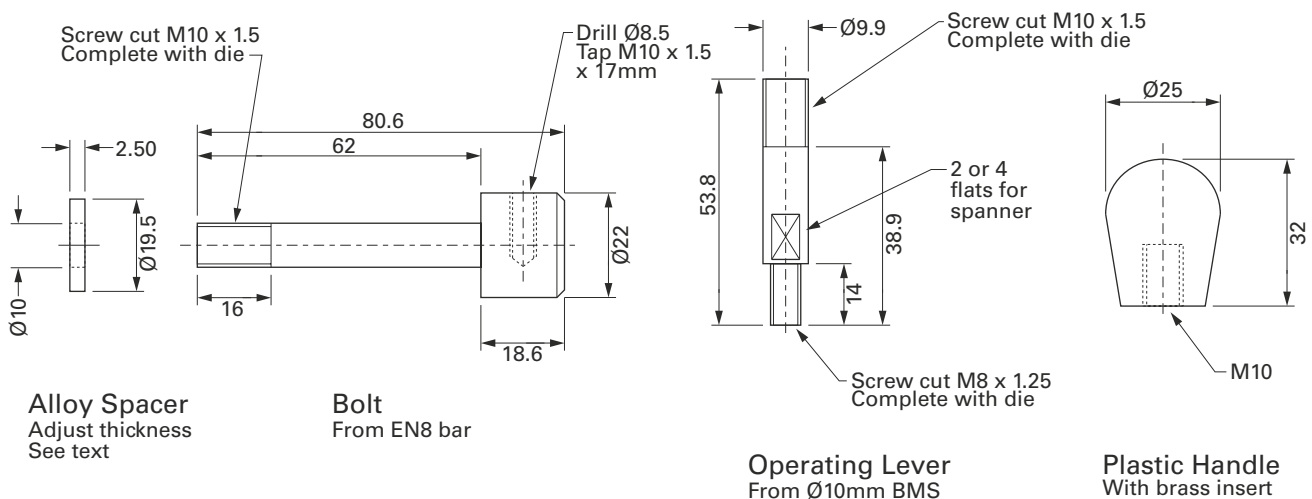
Fig. 1



Myford Carriage Lock

Myford carriage lock parts.

Fig. 2



Chester Craftsman Carriage Lock

Chester Craftsman carriage lock parts.

Remember to reduce the diameter that is to be threaded to less than the nominal as this avoids choking or even cracking the die or die nut. Measure the diameter across the threads of a commercial bolt to get an idea of the diameter you should turn the embryo bolt down to.

The only critical operation is making an alloy washer the right thickness to bring the operating lever to a position where it won't foul the tailstock or the cross slide. I screwed the bolts down until almost tight, noted where the lever was pointing and estimated the angular correction in a left hand direction, then calculated the washer thickness from the thread pitch. A piece of alloy bar was chucked up, bored to the bolt diameter, the outside diameter reduced and the calculated length parted off. There

should be no need to re-chuck the washer to reduce its thickness, which can be tricky. Remember to allow for the thickness of your parting off tool, 2.1mm in my case.

On the Myford the washer can foul the cross-slide jib adjustment screws so I made the diameter less than the bolt head and added sufficient thickness to raise the operating lever above the gib screw; however you want the top of the bolt head to be below the cross slide top.

The bolt heads were drilled and tapped held in the mill vice and the centre of the head found with a 'wiggler', very simple but effective devices. **Photograph 5** shows the hole being tapped with a spiral flute tap turned by hand in the mill.

Tapping the lock bolt head.



I machined two or four spanner flats on the operating handles using a 5C square collet block in the mill (**photo 6**). The Myford version requires the lever to be added after the bolt has been screwed in, so don't stick it in with anaerobic adhesive.

I carried out all the turning and parting off using an ER40 collet chuck on the Chester lathe, but an ER32 collet chuck in either lathe would do the job, provided you reduce the steel stock to 20mm from my 24mm. A mill isn't necessary for the manufacture of these locks; a vertical

slide with a vice would suffice for the drilling tapping and milling operations.

Both these carriage locks work well and I recommend them. Small design changes might be needed for other lathes.

Should you have any comments or questions write to Scribe a Line or email me direct at mikehaughton@btinternet.com ■



Milling flats on the operating handle.

Modifying an Electric Motor



Des Bromilow modifies a Motor Mount.

By using an existing motor casing and my aluminium casting equipment, I was able to convert an electric motor from a flange mount to a foot mount (**photo 1**).

As part of collecting up materials to build a Boyer-Casey T&C Grinder, an electric motor was taken from the store of useful parts. The motor was of sufficient rating and worked well, but was a flange mount style frame. The end cover was removed, and the bearing pressed out.

A wooden foot was grafted into place on the old flange using automotive filler for adhesive, and filleting (**photo 2**). The modified cover was then used as a pattern and a new cover cast.

The new cover was machined for the bearing, and placed on the motor for a quick test - all worked fine. The remains of the flange were then cut away from the new cover, and the foot mount drilled as appropriate for the task. The original flange cover was retained should the motor ever need to be returned to its original configuration in the future (**photo 3**). ■



The converted motor.



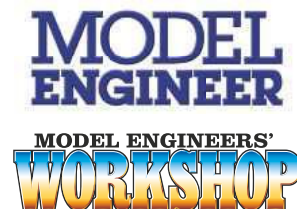
The pattern made using the original flange.



The motor and the original flange.

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20 years of owning a Chinese milling machine



Inchange recounts his experiences with an imported machine from the 1990s that is still available today.

This article is about my experiences with a small milling machine bought in 1995. Although the title states Chinese mine is actually made in Taiwan-Taiwan, the Republic of China, is an island off mainland China that didn't become part of the People's Republic of China in the communist revolution of 1949. 1995 was at the time that Taiwan was being pressed very hard by the communist Chinese government to become part of the mainland country.

My machine is made by *Rong Fu Industrial Company Ltd* and today the same machine is still made but it has had several cosmetic changes and the addition of new electrical switch-gear and safety guards to incorporate changes in the laws. My model is the smallest in the Rong Fu range and is officially called the RF-25. I see several companies who also sell this same machine but it has been badge-engineered to hide the real manufacturer. In a recent copy of *Model Engineer* I saw it being sold by Clarke as the CMD1225D.



The writers RF-25 milling machine.

The RF in the name of course is short for Rong Fu and the 25 denotes the maximum drill diameter it is rated for, 25mm. It is really a drilling-milling machine and it can be used for either task, but the X-Y tables are proper milling table types. It was one of the first small machines imported into this country in 1995 and I was fortunate to be able to be purchase one of the first batch for a not too considerable price as a special introductory offer. I had been looking around for a small milling machine but all the second-hand ones were much too big for my workshop. I could buy a clapped out Bridgeport machine for about what I paid for the new RF-25 (**photo 1**), but it was a monster by comparison and likely to cost as much again to get it working correctly. All the Bridgeports I found were fitted with 3-phase motors and this would be a problem for a single-phase domestic property. As it turned out it was a good thing I didn't succumb to the Bridgeports as soon afterwards we moved house to a different location. The RF-25 in its shipping crate weighed 190kg and the machine with all the standard accessories weighs 160kg without the crate.

The tool wholesaler I bought it from had a delivery service for no extra cost, as long as you lived in the area. The truck duly arrived with the machine in its large

wooden packing case and a small forklift truck was off loaded and picked up my new machine from the truck load bay and gently placed it on the prepared bench in the garage. What service! It then only remained to open the crate and there was my new machine in all its gleaming paint. But there is a snag. The base of the machine is fastened with ½-inch diameter coach bolts to a very thick piece of wood that the crate was built around. There was no way I was going to be able to lift it to remove the bolts, whose heads formed the feet of the crate, and then slide out the bottom piece of wood. Fortunately the two delivery drivers hinted that I might want to lift it again after I had removed the crate sides and they obviously knew the story. So all went well, the crate sides were removed, a sling was fastened around the head of the machine and the forklift lifted it the required amount to get the bolts out and the wood released.

At the same time as I bought my RF-25 a colleague at work bought the larger version, the RF-30. This as the name suggests is rated at 30mm maximum drill diameter and is about 30% larger and about the same in extra cost. At the time these were the only small milling machines that Rong Fu made, today they have a huge range to choose from, www.rongfu.com/en/Milling-Drilling-Machine.html has the full details.

I had a choice between the 3-Morse taper or R8 spindle and I chose the 3-Morse taper, which I think turned out to be a wise choice as all my other tooling is MT-2 and a 3-2 sleeve is quite inexpensive to purchase. The importers here did not bring in the optional cabinet stand with the first shipment, so I had to make alternative arrangements. For the first two years it was bolted to a wooden bench but this wasn't such a good idea as the bench began to sag under the weight, so an angle iron stand was fabricated. So what did I get for my money?

The basic specifications are:

Table size:	585mm x 190mm
X-travel:	380mm
Y-travel:	150mm
Z-travel:	95mm
Speeds:	90 – 2150 rpm
Column diameter:	92mm
T-slot size:	14mm x 24mm
Number of T-slots:	4

The machine came covered in rust proofing wax coating on all the bright metal parts that had to be removed with paraffin before one could really assess the beast. Rong Fu's workers did not spare the wax coating and even now 20 years later I am still finding bits I missed. As well as the machine there was a small wooden box, very roughly nailed together, I guess carpentry isn't Rong Fu's speciality. Inside were a 16mm capacity drill chuck, a milling vice, a 4-cutter thingy which after removing the wax was an inserted-cutter facing mill and finally a small tin of touch up paint and the operating manual. No spanners or Allen keys were packed with the machine. The operating manual was cheap and nasty and the English was poorly translated, but one could understand most of it. The exploded diagrams and the parts list with ordering numbers were the most useful part of the booklet. Fortunately having used larger milling machines I knew what was what as far as the operating side goes so I didn't worry too much about that part of the

booklet. Hopefully Rong Fu and the importers have by now sorted out these little problems.

I must admit that although the overall finish is definitely not in the same category as a Bridgeport machine, neither is the price, but the cast iron used seems to be fairly good quality and plenty of it in the right places. As is typical with the Taiwanese and Chinese machine tools I have seen they are not shy to the use of a bit of body filler to hide surface defects in the castings, often caused by blowholes in visible places.

The paint colour was a bit awful; my wife when she first saw it asked 'What on earth possessed you to choose that terrible colour, it looks like babies vomit!' Try explaining to a woman that the choice of colour is not like buying a new car. I didn't think it was that bad and it has grown on me over 20 years, a bit of oil and dirt actually make it look – well – sort of acceptable! If I wasn't so busy I would strip and clean it and then repaint it, but what colour I wonder would please 'her-indoors'?

The drill chuck is a typical Chinese product but in all the years it hasn't given a moments trouble. The milling vice by comparison was a real dog and it took many hours to get it to what I considered acceptable working fashion. Even now I wouldn't hesitate to change it if I could find a decent replacement at an affordable cost. The two thin strips of mild steel used to set the angle were completely inadequate to hold the top swinging part rigid under a decent depth of cut. The other detail missing was a positive locating key to align it with a table T-slot. To have to use a DTI every time one mounted the vice on the table is not acceptable in my book. These defects have now been corrected by me, but shouldn't have been necessary.

The face cutter also has been mostly trouble free apart from some *operator inflicted* damage, which could be rectified by regrinding the 4-carbide tipped inserts and it has removed lots of metal in its time. The motor fitted (**photo 2**) is a 1-HP (750W) single-phase induction motor and it looks big! In all the years I have never been able to stall it, the drive belts slip long before the motor slows down even under a big dig-in of the cutter. I cannot see a maker's name on it but whoever made it knows their stuff and I would certainly buy another of the same type.

The 12-speed selection is the usual V-belt drive and is quiet, simple and quick to change speeds and the range is quite acceptable (**photo 3**). It could perhaps have been better with a slower bottom speed than 90-rpm but it isn't often that one needs such a very slow speed, so one can live with it.

The table has two wells (one at each end) fitted for the collection of the coolant, but there is no hole to allow this to drain. The optional cabinet stand has a coolant drip tray fitted and a coolant pump space in the bottom of the cabinet. I drilled two holes in the wells to allow the coolant to return to the drip tray, which was a home-made affair bolted between the bottom of the machine and the stand. However, when the drip tray was fitted the ability to access the bottom of the machine and particularly to be able to adjust the Y-axis feed nut was lost. There cannot be a hole in the drip tray as the base casting does not seal to the drip tray because there are small gaps along the sides as the main feet are located at the corners where the bolts are located. Both the X-axis and Y-axis bronze feed nuts have adjustment by tightening up a small cap screw to reduce the backlash. The X-axis adjustment can be made (with difficulty) without stripping the table and the Y-axis without the drip tray is easy to access from below the base. Although the nut-leadscrew clearance can be adjusted the end float of the lead screws is not adjustable and over time wear develops which generates some backlash. To cure this entails shimming the leadscrew thrust collars to take up the slack. The slide lead screws are both 10 tpi, and this gives a movement per turn of the handle of 0.1 inch (100 thou). Since there are 25.4mm in an inch the error over one-turn is 0.04mm (1.6 thou) and over ten-turns is 0.4mm, about 16 thou, so no great error. I suspected the RF-25 is an imperial machine and this factor confirmed my suspicions when I accurately measured the lead screw pitch. The backlash in the feed screws is likely to be more than this amount of error.

The Downsides

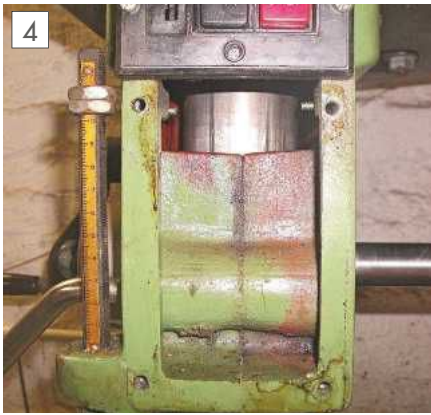
The mill does not come with power feed to the table. Although there are now optional electronically controlled feed motors they are expensive and I didn't think the cost



The 1-HP motor fitted to the RF-25.



The drive belts and pulleys of the RF-25.



To lubricate the quill you need to remove the faceplate.

was justified. Equally, there are no coolant pump and associated accessories. I fashioned my own using a large aquarium pump in a tank that serves both the milling machine and the adjacent Myford Super 7 lathe.

The two column clamping bolts lasted all of 3-months before they started to strip the threads. I have seen numerous comments about this problem from other users on the Internet. The steel used is just not up to the job, and I had to get new high tensile bolts fabricated because of the odd hexagonal head sized used. (The heads fit into hexagonal pockets in the headstock to stop them rotating when the nuts are tightened and I discovered they are odd size imperial not standard metric size heads). The bolt head was for a $\frac{5}{16}$ inch bolt but the bolt was $\frac{1}{2}$ inch diameter, and they are actually $\frac{1}{2}$ inch Whitworth bolts. I cut off the bolt head and had new bolts made from 12mm HT bar threaded M12 and welded the original bolt head onto the new bolt shank. I certainly hope Rong Fu has sorted this problem out by now, because it spoils what is otherwise a good machine. Strangely for a so-called 'metric machine' it almost exclusively uses Whitworth threads. I have only found a few small screws that are actually metric.

5



Gib strip after much attention to surface.

The V-belt from the motor to the idler pulley gave up the fight after a couple of years and had to be replaced with a better quality belt. I found an equivalent made by Ram in the local auto parts store and this has been 100% ever since. Strangely the other belt, although now looking a bit ratty after 20 years, still works fine.

Lubrication seems to be sadly lacking on the machine. The cross-slides and handles have silly button oil nipples pressed in which seem to deposit more oil on the floor than enters the bit you need to lubricate. The head and quill has no accessible oiling points and you have to literally strip the machine to get oil into these parts. It would have been simple to provide at least an oil nipple for the quill shaft on one side of the headstock casting. In fairness the amount of grease applied during manufacture would probably outlast the machine, it is enormous in some places.

The good part is the headstock bearings are very good, being 4-sealed heavy-duty tapered roller and thrust ball bearings that have only recently started to emit a faint rumble. For all the bearings I have been able to get sight of the manufacturer's part numbers are standard types and should be inexpensive to replace, when the time comes. The dial indicators on the cross-slides and the quill down feed are metric graduations and easy to read with one exception. The down feed dial is almost totally obscured by the handle and the index mark is at the top at 12 o'clock that means it is difficult to see. My machine is mounted on a home-made stand welded up from substantial angle iron and tied to the brick wall at the rear in two places to eliminate vibration and it is a bit taller than most people would choose, because I am a tall person. If the machine were mounted on a normal bench, or the optional cabinet stand, the dial would be easy to read, but this gives me a pain in the back having to bend over to operate a machine. I am making a new index plate which is also adjustable; the two other dials have adjustable index plates but not the down feed dial.

The slide gib strips were of unbelievably poor quality. Although the steel used is a good grade the machining was awful. The rubbing surfaces looked like they had been cut with a chisel and rubbed with a file to get a smooth finish. Adjusting the gib

strips was a waste of time; I just couldn't get a nice action. A ground finish would have been preferable. The gib strips are tapered and have an angle of 0.55° . To set this up on a surface grinder would take a lot of care to get the angle correct. I finished the gib strips by using a small slip stone to get a working surface as flat as possible. Having spent many hours on the gib strips they are now acceptable, not perfect but acceptable (photo 5). It is niggling defects like this that leave a bad taste in your mouth. By comparison the slide V-ways machined in the cast iron parts are well machined, although not ground they are hand scraped and more than adequate.

The gib locking screws, called leaf screws in the manual, work well on the X-axis but the Y-axis ones were a huge problem. Because they hang down (photo 6) and are above the side of the machine they can dig in when the Y-axis is being moved towards the operator and cause the movement to tighten up without notice. After a while I unscrewed them and modified them with T cross bars that didn't catch in the side of the casting (photo 7). The screws are $\frac{5}{16}$ inch Whitworth. They are still not perfect as to reach under the table to get to them leaves your fingers covered in oil. It was the digging in of the side 'leaf' screws that showed the amount of body filler that had been used on the base casting, it is 4mm thick in some parts. The two sets of leaf screws use the same part, if the Y-axis screws had been made about 25mm longer the leaf portion would have cleared the casting drip section and not be able to dig in. I noticed by magnifying the latest RF-25 image on the Rong Fu website that the Y-axis locking screws have been changed to T-headed screws similar to my modification, so they must have realised the problem. The X-axis screws are also a better design than the original type.

When it was time to move to our new house I had a problem to move the machine. I had no way of lifting such a heavy lump in one piece as there was no suitable sky-hook near the machine to attach a chain block to, so it had to be split into manageable pieces for transporting. The furniture removal company stated that they were not happy to move the workshop equipment, so it was down to the lads from work to do the heavy lifting. The head on top of the column, which also



X-axis leaf screws.



Y-axis original leaf screw and modified screw with T handle.

contains the motor and pulley system, was simple to unbolt and lift to clear the top of the column. This in itself is a heavy chunk of metal and needed two fit people to lift it, and two more on the ground to take it from the two on the bench top. The column was fastened to the bed by 4 Allen bolts and these when undone allowed the column to be separated from the base portion. This however as you will see was a big mistake! This joint was filled with body filler and looked as if it was all in one piece until you rocked the column to lift it. The bottom portion with the two cross slides was just manageable by two strong people but it was close to hernia time!

To put it all back together at the new house had to wait for about 6 months whilst the other chores took priority. Finally, the day arrived and the carefully stored pieces were readied. I had the foresight to select a place in the double garage (that doubled as a workshop) to have a substantial roof beam close to the rear brick wall and directly above the site of the new stand, which was already bolted into the concrete floor. Using a 1-ton chain block and some nylon strops the base was lifted onto the stand and the 4-bolts loosely dropped into the holes. One person could just about lift the column and this was fixed in place with the 4 cap screws and torqued down.

Finally, the chain block was used to lift the motor assembly with the headstock to slide it onto the top of the column. After much cursing – the elevation rack wanted to keep falling out at a critical time – it eventually all lined up and the chain block lowered it into place.

Now we could check things out. It wasn't working the way it should and careful measurement showed that the column was leaning slightly to one side and backwards. How could this be? Great care was taken that no dirt was between the column and the base before it was fitted. It was only several days later that I discovered some brass shims on the floor where the pieces had been stored and then the penny dropped. These must have been fitted in manufacture to get the column to be correctly aligned. So out with the chain block again and lift the headstock with the column up to put in some shims. Fortunately by this time with the assistance of a friend we had more or less established the shim thickness from measurements made on the column lean. So in they went and torque up the bolts and recheck the alignment. Still not right. It took over 4 hours of hard work to get it spot on. The moral of the story? Do not split the column from the base under any circumstances, unless you want to go through this arduous process.



Cast in hole in bottom of headstock begging for a lamp.

The Future

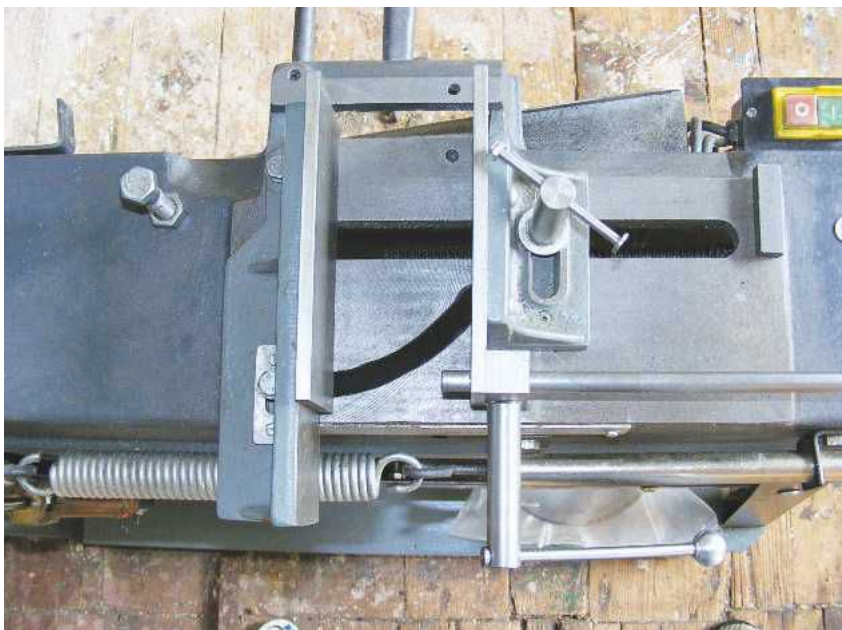
There is an interesting hole cast into the bottom of the headstock that would take a lamp to illuminate the work on the table (photo 8). I noted that this is a common addition from a website on the Internet.

Would I buy another RF-25? Well thankfully it is not a question likely to trouble me. But knowing what I do now would make me think long and hard. Assuming that Rong Fu has corrected the niggling problems I had with my early production machine I would say it was good value for money. As the Americans say 'Your mileage may vary'. ■

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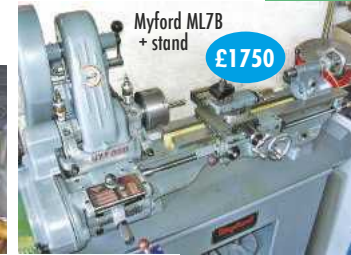
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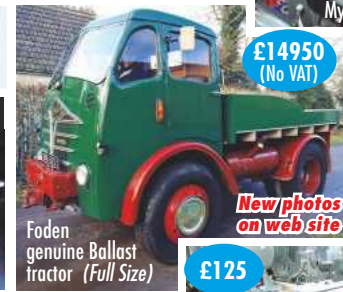
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